34th YEAR OF PUBLICATION

Chemical Weekly

VOL. XXXIV APRIL 25, 1989 NO. 33

Edited by R. Raghavan and published by N.R. Rajagopalan on behalf of owners, Sevak Publications, 306, Shri Hanuman Industrial Estate, Wadala, Bombay-400 031. Madras Office : 27, Begum Sahib 3rd Street, 1st Floor, Mount Road, Madras 600 002. Phone : C/o 831808 and printed by N.R. Rajagopalan at Sevak Publications, 25, North Mada Street, Thiruvanmiyur, Madras 600 041. Phone : 419265. Registered with the Registrar of Newspapers for India vide No. R.N. 1972/57.

THICKENING AGENT

(FOR NON-AQUEOUS SYSTEMS)

Suggested Applications

Paints/Coatings
Putties & Sealing Compounds
Nitrocellulose Lacquers
Caulk & Mastics
Sealants
Epoxy Systems
Polyurethane Coatings etc.

For Further Details Contact Manufacturers

FINE ORGANICS

15/2, NEELKANTH MARKET, M.G. ROAD, GHATKOPAR (E),
BOMBAY 400 077

Telephones: 5135471 / 5135356 / 5135687

CHEMICAL WEEKLY

VOL. XXXIV APRIL 25, 1989 NO. 33

HERALDING THE 21st CENTURY - 17

Emerging Conflicts between Man and Machine?

We are now at the beginning of the age of robots. There are some 25,000 robots in the world today and it is estimated it will rise to 115,000 in the next few years; some place it at 200,000. The robots that exist today are by no means the seeing, speaking, thinking, humanoid types we often read about in Science Fiction. Today's robots even in their simplicity, are finding a place where they can do dangerous work or withstand dangerous conditions which human beings prefer to avoid. Robots can work in space, in mines, underwater; they can deal with explosives, radioactive materials, poisonous chemicals, pathogenic bacteria, high temperatures, pressures, heights and so on.

Most of all they can do work, which while not physically dangerous is so repetitive and dull that it stultifies and debases any human mind, if engaged on it for long periods. Robots can do dull repetitive work indefinitely without getting bored or sullen and can do it with the highest standards for correctness, reproduceability and reliability. The world's most forward futuristic factory has been erected by General Motors at Saginaw, Michigan for the fully automatic production of front wheel drive axles. Technology is king here. Lasers inspect parts and check for wear on machine tools. Experimental robots piece together components, shaped by automated equipment. Driverless automated vehicles whiz about, picking up and delivering parts.

Hardly a human works among the multitude of robots, only 42 hourly workers are spread over two shifts and eventually the plant will add an overnight shift with no human presence of any kind. Overhead, perched in a glass walled command room, a handful of engineers and technicians run the factory. Seated at a bank of computer terminals, they despatch production orders to the shop floor and monitor the results. Because of the computer network linking the neat rows of machines, the plant can switch from one product line to another in just 10 minutes -- a far cry from the change over times in conventional factories which are closer to 10 hours or even ten days in some cases.

The wealth of technology represented by the Saginaw factory, is dazzling. But the question that arises is about its practicability. General Motors are the first to admit that it is not. Half the machines are costly ones of a kind of prototypes, and half the plants operating budget is devoted to research and development. The axles that the Vanguard cranks out costs twice as much as those produced conventionally. But this plant is justified only on grounds of future outlook and for keeping up the race with Japan. It is learnt that the General Motors executives visiting the Servo motor plant in Japan were impressed by the highly automated plant at FANUE Ltd. Vanguard has helped General Motors to test their early versions of Manufacturing Automation Protocol (MAP), a system that allows different brands of computerised equipments to communicate. It also serves as a pilot plant for an artificial intelligence system, dubbed "CHARLEY" that helps predict when machines will need maintenance attention.

General Motors realised that Vanguard would fail without the support of the Auto worker. So it set up an advisory committee to help decide such things as to how many people would be needed to run the plant. For most workers, the factory of the future meant loss of jobs. But they also realised that without newer and better technology, "the world will by pass the worker". They developed the progressive feeling that "ultimately it is their succesSs in getting the technology to work for them". On a net reckoning, it is the accountant's quandry whether these "gee-whiz" technologies are cost effective that will decide the issue. There is another futuristic factory solely built for better quality with labour savings. The $700 million joint venture between Chryslar Corporation and Mitsubishi Motors Corporation, is crammed with 470 robots with 100 automatics working on the final assembly line. The cost of all this technology is certainly prohibitive. The conventional financial guidelines are not applicable.

American Scientist, Joseph Engelberger predicts, that robots are about to invade our homes. He envisages that in about two and half years, domestic robots, semi intelligent independent machines, will be available to vacuum cleanse, wash dishes and clean bath rooms. These domestic robots should be blessed with a level of artificial intelligence to enable them to act independently. The "nurses aid" robot has a map of the hospital in an on board brain so that it can go to any section of the hospital on its own. There are no wires on the floor. It looks with infra-red and can navigate around the people and can even use elevators.

Engelberger says that the domestic robot, costing about 42,000 dollars will be a sophisticated machine and the earliest customers will be deciding between buying another Mercedes and an honest to God robot servant. The household layout in modern homes will be modified to suit the free movement of robots, with organised storage space, and the

regimentation of such duties as laundry work and food preparation. The household robot will share its quarters with the home heating, ventulation and air conditioning systems including the home's supervisory computer which will be in charge of task assignment, scheduling, energy management, fire detection and communication. Above all, the domestic robots will have unwavering respect and adherence to Isaac Asimov's three laws of robotics which lay down (1) that robots should not have humans, (2) should obey humans and (3) should protect their own existence. It goes without saying that the third law will be adhered to only when it is not in compliance with the first two.

Protagonists of the robots for accelerated manufacturing techniques and productivity claim that the robots liberate human beings from dull repetitive work and frees them to undertake more creative work. Very often the term "liberated from an undesirable job" might just be an euphemism for being thrown out of work. A job may seem undesirable to some one viewing it from outside but to the person working at it, it is his livelihood. The robot brings with it, in other words, the threat of technological unemployment and with that the loss of economic security and the disappearance of self-respect.

It may be argued that, as it happened in the case of the automobile, there will be the steadily growing need for designing, programming new robots, for maintaining the robots already in use, for building robot manufacturing facilities and remodelling whole industries for the proper use of robots. Thus it is claimed that there will be more work, more jobs, by far in a robotized society than in a non-robotized one. This however is a overall long range view that overlooks completely the individual tragedies that take place while society changes its mode. When one job disappears, another may not immediately reappear or it may do so at a far off place and may be totally different in nature. An assembly line worker who has been doing routine on line bolt and nut jobs cannot, when his job disappears, at a moment's notice become a robot repairman.

In fact it is generally conceded that those employees replaced by robots will not qualify for new jobs that open up. The jobs lost to robots are precisely those that robots can do -- mechanical, repetitive, and non-creative. The new jobs will require considerable specialised knowledge and thinking prowess. The society cannot wait for these dislocations to adjust by themselves. If society is to be kept stable, there must be serious efforts to minimise the pain and trauma of the transition period. Large programmes of retracing and re-educating may have to be undertaken to make the job transfers as feasible as possible. Retraining and re-education may not be a panacea by themselves. There may be a sizeable number of people who because of age, temperament or lack of will would find such retraining difficult or actually impossible. They will have to be cared for and they should not be left to fend for themselves or abandoned.

The only consolation will be that the transition period, though painful and expensive, should not last long. With proper changes in education, a new generation should arise that will fit into a computerised and robotized world. The new generation, will from childhood, be taught to do creative jobs that the robots cannot do. But during the transition period there would be heavy clamour, strong agitations against the introduction of robots claiming that it would be disastrous and would dislocate human society beyond redemption. Such a pessimistic view cannot be justified if one were to renew the social history of the past century, especially against the background of changes brought about by the industrial revolution. In spite of the many social convulsions wrought by the industrial revolution in the currently advanced countries as also the developing countries, the quality of life has improved allround and the percentage of people living below the poverty line is gradually -- too slowly some may say -- receding. This welcome change will be accelerated with the introduction of the age of the robots, in spite of a hesitant start and prolonged travail.

Against this vauge promise of hope stands another dreaded prospect. Robots may be made even more sophisticated and more capable, they may come to be designed with manipulative hands and develop various senses; they may ultimately develop capacity to reason -- artificial intelligence. This will take away more jobs, more complicated jobs and more creative jobs. Will human beings be forced into idleness and boredom, dying for sheer lack of challenge to give life meaning. In short would homo sapiens become first redundant, then obsolete and then exinct and would the robots become a superior being, even if not human. But these are dyspeptic and unpleasant imaginings. There is a simple query if the human beings were to be left unoccupied and therefore unremunerated, where will be the outlet for all the products produced by the robots? Thus the real aim of robots and computers will be the one of creating a better world and not one adding to human misery.

Replacements of the role of human beings by Robots is impossible for the simple reason that the human brain cannot be outsmarted by the computer, (this we shall examine in the next article). The modern robot may be viewed as a computer to which limbs, organs, tools and other equipment has been attached. The computer is to the modern robot what the brains are to the human. It is the brain which allows the limbs, organs and tools to broaden the range of occupations the robots can engage in. Robots differ from other automated machines and equipment in possessing the ability to learn to be programmed for a wide variety of activities. Some extremely advanced computer robots are capable of learning from their experience -- they can for example, play a better game of chess.

The computer is built of solid state electronic devices, designed essentially to do arithmetic. Any problem however, seemingly complex, can be broken down into a well defined series of arithmetical operations, each of which it can perform in microseconds and can do without any chance of error. But the business of the brain is to "think" philosophically, imaginatively and come to conclusion or draw inferences. The chances are always there that the human brain will increase its efficiency and its capabilities so as to evolve better robot designs and so on in a leap frog effect. Man's progressive march into the next century and thereafter will depend on his ability to master the robot and coexist with it. In the net result, robots and human beings will continue to advance along parallel paths with each carrying on in a steadily improving fashion, jobs which it is best fitted to do. With the widely different talents, they have to function as allies rather than antagonists and achieve ever increasing areas of understanding of the universe and its laws, accomplishing far more together than what could possibly be achieved alone by either. After all, the robot is a creation of man and it cannot exist without him and as such there can be no question of the robot replacing man.

-- T.P.S. RAJAN

(Source: (1) Between Man & Machine, Ernest R. Tello, *Byte*, Sep. 1988; (2) G.M. bets an arm and leg on a people-free plant, *Business Week*, Sept. 12, 1989.)

CHEMARENA

S.L. VENKITESWARAN

Middle East prospers with petrochemicals

The Middle East oil rich countries have prospered in their petrochemical ventures -- bold moves in the wake of the oil shocks administered to the rest of the world. Not only had they a lot of gas being flared away but they had the funds and power to induce oveseas giants to tie up or provide technology. In fact the planning and organisation of their petrochemical projects is through foreign consulting firms who have vastly benefited. One of these firms, Chem Systems of USA and UK had organised their second seminar in Bahrain recently to discuss Middle East Energy and Chemicals. (*CE News*, 6th March). The participants included Middle East/-Gulf organisations, Japanese and Western multinations and financers.

The ethylene based on gas otherwise flared -- containing ethane which is separated -- is the cheapest in the world and consequently the polyethylene made from it. Production costs of ethylene and LLDPE in Middle East as compared to other countries are given in Table-1.

Table-1

(Cost in cents/lbs)

	Ethylene		LLDPE	
	1990	2000	1990	2000
Middle East	6-7	8	17	20
US Gulf coast	8	22	33	45
W. Europe	12	24	32	45
Alberta Canada	9	21	17	27
Japan	12	27	36	48
S. Korea	12	27	35	47
Taiwan	11	25	33	47

There are difference in the feedstocks used but the basic situation is that Middle East can dominate the trade in LLDPE for the next decade if they continue to build more capacity and import policies of countries are favourable.

The polyethylenes top the table in capaity and demand among petro polymers as per Table-2.

Of the worldwide demand of about 38.7 million tonnes of polyolefines in 1998, LLDPE was 10%, LDPE was 36%, PP was 27% and HDPE 27%. The share of LLDPE will increase to 17% mainly at the expense of LDPE by 1995 -- out of a total of 53.4 million tonnes.

But the centre of discussion is on the future -- how far downstream can the Gulf countries go and in what direction and with what consequences. They have over half of world methanol production now with 9.4 million tonnes -- a far greater dominance due to methane of no cost. The share of ethylene is lower at only 4.5% out of 54.6 million tonnes but inching up. Middle East has poor resource in aromatics due to the nature of the crude and naturally it is only the flared gases which give them the most advantages in products for which they are appropriate. The Gulf region has 14% of the world's gas reserves and this also provides cheap energy for electricity-intensive products like chlorine for PVC.

A long list of old and newer and higher value products have been indicated as appropriate for the continuing expansions and major ones are listed in Table-3.

MTBE is an item which is being taken up in a big way for which Middle East is well placed although USA and West Europe are also going ahead on their own.

Table-2

Polyethylenes top Middle East Capacity and demand

(Thousands of metric tonnes per year)

	1985		1990		1995	
	Capacity	Local demand	Capacity	Local demand	Capacity	Local demand
LDPE	414	265	454	335	514	380
LLDPE*	510	36	560	75	550	95
HDPE*	230	110	470	180	600	220
Polypropylene	60	147	60	190	445	230
PVC	185	320	415	440	490	560
Polystyrene	25	95	150	160	240	220

Note: Includes Turkey, excludes Egypt; LDPE = Low density polyethylene, LLDPE = linear low density polyethylene, HDPE = High-density polyethylene, PVC = polyvinyl chloride.

*Spring capacity/demand can be used for either HDPE or LDPE). Source: Chem Systems International

Table-3 •

(in '000 tonnes)

	Additional Capacity	
	Short term	Long term
Methanol	1500	--
Propylene	200	800-1000
Urea	--	3000
Polypropylene	100	500-500
HDPE	90	--
Petroleum Coke	300	--
Acetic acid	80	--
Acrylic fibres	--	50-70
Butene/Butdiene	--	100
Isobutene	--	15-20

In the context of the developments in the Middle East and our own poor standing and attempts to import olefin from Middle East, is there a case for tie up in projects for the end products which we need instead of a half way house? India's uncertain policies, tardy pace and financial stringency have resulted in a miserable situation even in items where we could be on top -- methanol, aromatics, PTA and polyester, styrene etc. Meanwhile the Government authorities are bombarded with numerous programmes and pressures with the result that a clear perpsective is not evident. If we are considering a fertiliser project in the Middle East there is no reason why it should not extend to polyethylenes or it could not be two way traffic with Middle East investments for a BTX complex (with downstream products) in India based on our aromatic rich naphtha.

Highest US Chemical Award to inventor of LLDPE process

Dr. F.J. Karol of Union Carbide gets the Perkin Medal for 1989 -- the highest for chemical discoveries in USA. Dr. Karol is the architect of the unique catalysts and conditions for the Linear Low Density Polyethlenes (LLDPE) over a period of devoted research for 15 years. A Ph.D. of MIT, his objective was on a low pressure route to LDPE and catalyst development which has ultimately resulted in Union Carbide's Unipol process for polyethylenes which are also linear and not random branched as with the high pressure system. The first commercial plant was at Seadrift, Texas and today there are 28 licences (end of 1988) with production of 10 billion pounds in 50 reactors. The Unipol process is said to work at 300 psi and 80 to 100°C as against the earlier 30,000 psi and 300°C. The process is able to incorporate various comonomers in about 5% proportion to yield a wide range of resins using different catalyst formulations. Apart from the uniqueness of the polymerisation system, Dr. Karol and colleagues had to evolve altered extruder screw and conditions for processing LLDPE and convince the users of the advantages. The Unipol technology is also used for polypropylene -- a gas based fluidised bed polymerisation -- and commercial production has started. As Dr. Karol himself has mentioned, this is a quantum jump in catalysts. Others are also in with their own versions of LLDPE and India's IPCL is tying up with British Petroleum instead of Union Carbide. Union Carbide has sold off their tiny plant of 20,000 TPA in Bombay to the Oswal Group but this is on the original high pressure technology unless the new owner decides to go in for Unipol technology on a larger scale of both cracking and polymerisation.

Ozone -- outlook is bleak

The International Airborne Arctic Stratospheric Expedition to assess ozone depletion over the Arctic region has completed its study and the findings do not provide any hope for the future even if there is no "ozone hole" in the Arctic. The Arctic stratosphere temperature in winter goes down to -80°C and the polar vortex breaks up before the sun returns but there are active chlorine monoxide, the destructive agent -- as high as 80 ppt -- the "smoking gun" of ozone loss. There is a dispersal of these molecules before sunlight reappears and causes photo-reactions to destroy ozone. There is no doubt on slower depletion to the extent of 5 to 6% since 1970.

The cold temperatures lead to two types of clouds. Type I at -77°C is mostly nitric acid trihydrate which is harmless while Type II at -85°C consists of water ice crystals which provide the base for heterogenous catalystic reactions as observed over Antartica as illustrated below:

$$HCl + ClONO_2 \text{ ----- } HNO_3 + Cl$$
$$H_2O + ClONO_2 \text{ ----- } HNO_3 + HOCl$$

Both the molecular chlorine and HOCl fly off from the surface and can be photolysed to radicals that catalyse ozone destruction. Even if the Type II cloud is formed when temperature touches -85°C the arctic darkness seems to save the situation. It is a race between how fast molecular diffusion can bring in nitrogen oxides to react with active chlorine and how fast the chlorine starts destroying ozone. So far the situation is much safer than in the Antarctic Vortex clouds.

The slow steady depletion of ozone is there and more CFC's discharged into the atmosphere will only lead to accelerated depletion. 1% depletion of ozone leads to a 2% rise in skin cancer and worse things to follow. The Montreal understanding and argument aims to cut down CFC emission by 50% before 1998. This may not be adequate because the level of 3 ppb chlorine in atmosphere today will rise to 6 ppb before end of the century. What is added in one year takes 10 years to get removed. It may be necessary to monitor progress of CFC reduction to ensure that there is steady annual reduction leading to 50% by 1998.

CCS for caustic soda flakes allowed

The government has allowed five per cent cash compensatory support on the export of caustic soda flakes with effect from April 1, 1989. The rate of CCS will be reviewed once in six months, according to informed sources.

The government decision is in response to repeated representations from the caustic soda industry. There has been a glut situation in the caustic soda industry for some years and the industry was finding it difficult to export because of high production costs.

In spite of this, some of the leading manufacturers had exported caustic soda last year. The industry has been pleading with the government for a minimum CCS to make exports competitive.

It may be recalled that caustic soda was imported in large quantities till 1987 at very low prices. However, the situation has been reversed with the change in the import policy in 1987.

But power cuts imposed in different parts of the country during the last two years has reduced the surplus in caustic soda drastically. The 40 per cent power cut in Tamil Nadu badly affected caustic soda output of three big units.

As caustic soda manufacture is highly power intensive, any cut in electricity availability or revision in power rates directly pushes up the cost of production, the sources say.

There has been a lot of export enquiries for caustic soda especially from Indonesia and other south east Asian countries lately. These countries were earlier importing the same from Saudi Arabia.

Domestic production of caustic soda in 1988 is placed at about 8.4 lakh tonnes. The demand is expected to go up by 20 per cent in the current year. An additional capacity of the three lakh tonnes would be added in the next two to three years, the sources said.

POTASSIUM CHLORATE UNIT PLANNED IN BENGAL

A medium-scale project to produce potassium chlorate is to be set up in Jalpaiguri in West Bengal by two entrepreneurs, Mr. S. Lahiri and Mr. S.S. Lahiri, who are in the process of floating a company under the name and style of S.L. Chlorate Pvt. Ltd., for this purpose. The project, which will involve an investment of Rs. 2 crores, will be the first of its kind in the eastern region, say the promoters.

West Bengal Industrial Infrastructure Development Corporation has leased a piece of land at the Dabgram Industrial Growth Centre in Jalpaiguri to the entrepreneurs. West Bengal Industrial Development Corporation and United Bank of India have agreed "in principle" to provide term loan and working capital. It will have an installed capacity of 630 tonnes although the licensed capacity is 730 tonnes.

Potassium chlorate is mainly used in the safety match industry. Apart from the organised sector, there are over 23,000 cottage sector units engaged in the manufacture of safety matches. User-units do not always get potassium chlorate at reasonable prices because of its insufficient production.

Available data show that while in India the total production of potassium chlorate is about 10,000 tonnes per annum, the demand is almost double this figure. As a result, many safety match units in the cottage sector are forced to pay exorbitant prices or make match sticks without using potassium chlorate.

Match sticks that do not contain potassium chlorate along with gun powder extinguish immediately after ignition before the stick catches fir This unit, when it becomes operationa will augment supply of this vital inpu to small safety match units.

There also may be scope for som new safety match units to come up i the eastern region. The unit will provid direct and indirect employment to 90 persons, say the promoters, Mr. S Lahiri and Mr. S.S. Lahiri.

HERDILLIA UNIMERS TO BE TAKEN OVER

Herdillia Chemicals Limited has received the government's consent for the takeover of Herdillia Unimers Limited by buying 62 lakh equity shares of Rs. 10 each at par value out of the fresh issue of the latter. The proposed investment of Rs. 620 lakhs will be met from internal resources.

As in the case of IEL, Herdillia Chemicals was set up in collaboration with an American Company, viz. Uniroyal Chemical Company for the manufacture of 10,000 tpa of ethylene propylene rubber (EPR).

Following the revision in the project cost of the EPR unit the investee company is coming out with a fresh equity issue worth Rs. 1,300 lakhs out of which the Herdillia Chemicals is subscribing to Rs. 620 lakhs (47.70 per cent).

One condition of the above approval by the government is that the Herdillia Chemicals holding in excess of 40 per cent of the equity of Herdillia Unimers will be divested within three years from the date of commencement of commercial production of EPR.

Herdillia Chemicals is engaged in the manufacture of phenol, acetone, diacetone alcohol, phthalic anhydride, alpha methyl styrene, phthalates and capacitor fluids for use in plastics and petrochemical industries.

DR. O.P. KHARBANDA

FRANKLY SPEAKING

O.P. KHARBANDA, Cost & Management Consultant,
501, Olympus, Altamount Road, Bombay-400 026

Honeymooner's Love Canal

This story is based on one of the chapters by Russell Mokhiber and Leonard Shen, in an exhaustive volume entitled, Who's Poisoning America -- Corporate polluters and their victims in the chemical age, Eds: Ralph Nader, Ronald Brownstein and John Richard, (369p, Sierra Club Books, 1981, $12.95). According to this investigative report, there are tens of thousands chemical waste dumps in the U.S. Our present story relates to one of these over a thirty year period leading to a catastrophe in the LaSalle district of Niagara Falls, New York -- the honeymooner's paradise.

Love Canal was named after a nineteenth-century entrepreneur, William Love, who conceived of a navigable power canal to serve the massive industrial complex in that area. Digging of the canal started in 1894, but the project had to be abandoned because of economic depression. It was used as a recreation spot until 1942, when Hooker Chemical bought it over for use as a dumpsite for its chemical waste products. The drums and liquid waste dumped into the canal was covered with a clay casing and dirt. In due course, grass and weeds grew atop the covered canal, creating a field which gave no indication of the toxic materials underneath. The list of chemical waste included benzene, chloroform, lindane, trichloroethylene, methylene chloride and even trichlorophenol containing traces (about 130 pounds in 200 tons) of the deadly dioxin or TCDD (2,3,7,8-tetrachlorodibenzo-para-dioxin). A mere 3 ounces of TCDD can kill over a 100 million people, a fact which became known 20 years later in connection with the use of Agent Orange (2,4,5-T, a herbicide inevitably contaminated with dioxin) to defoliate the Vietnamese countryside. This land was acquired in 1953 by the Board of Education from Hooker for a nominal $1 and the sale deed stated that the Board assumes all risk and liability thereof.

The Board's attorney, Ralph Boniello did warn about the consequences, but in their enthusiasm at the generous 'gift', they failed to listen. In due course, a school was built on thi site, and on some days, there were odours so strong that chil dren had to cover their noses. No official complaints wer made, after all Hooker was one of the largest employers i the area. As a result from 50's to 70's there was a stead deterioration of the environment and ever increasing case of drowsiness and depression, liver disorders, abnorma number of miscarriages and deformities amongst the new borns.

The climax came in August 1978 with national press and television crews descending on the city, an emergency declared and plans drawn out for evacuation of the worst affected families. But whereto, at what cost and who was to bear the cost? A $0.5 million project to clean up the 'mess' was rejected as being too expensive. A year later, the cost shot up to $50 million. Even groundwater was found to be contaminated, and the State agreed to buy homes of the remaining residents in the area who wished to leave. Federal funds were sanctioned to temporarily relocate 710 families.

In a larger context, Love Canal was found to be merely the tip of the iceberg, with several thousand improper waste sites all over the country. The law against these was not only vague but its enforcement left a lot to be desired. It is serious enough for one of the editors (Ronald Brownstein) to observe:

> In the wake of Love Canal ..... and all other disasters of the decade, the real cost of (environmental pollution) began to emerge ..... (It) was no longer just a question of cleaning up rivers ..... or protecting wild lands ..... or even saving waterfowl ..... it was a question of saving ourselves.

The lesson is driven home hard, but will we ever learn?

Quantum jump in chemical exports seen

A quantum jump is estimated in the exports of chemicals, agrochemicals and dyestuffs from Rs. 306 crores in 1987-88 to Rs. 570 crores in 1988-89.

Exports of pharmaceuticals are estimated to have gone up from Rs. 290 crores in 1987-88 to Rs. 350 crores according to the annual report of the Department of Chemicals and Petrochemicals for the year 1988-89.

In fact, in the pharmaceutical sector, a perspective export plan for 15 years has been formulated, the report said.

The production of drugs and pharmaceuticals continued to show an upward trend. As against the production of Rs. 377 crores of bulk drugs and Rs. 1,827 crores of formulations in 1984-85, the production in 1988-89 is estimated to be of the order of Rs. 530 crores and Rs. 2,690 crores respectively, the report said.

The annual report said the country has become self sufficient in almost all major heavy chemicals. The installed capacities of methanol and phenol have almost trebled from the level of 1984-85.

The production of pesticides is steadily increasing and imports had gone down progressively during the last three years. The report said the petrochemical industry which is being treated as a thrust area for development has made rapid strides during the last four years and domestic production of various petrochemicals has registered an impressive increase.

A perspective plan for petrochemicals, covering the period upto 2000 AD has already been finalised and additional capacities are being considered. Some major projects in this sector have already been identified.

The annual report said a mega petrochemical project -- Maharashtra gas cracker complex is under implementation by the Indian Petrochemicals Corporation Ltd. (IPCL), a public sector undertaking under the Department.

The project is expected to be mechanically completed in August next. IPCL has also set up a well equipped research and development centre for petrochemicals.

Steps are underway to set up 27 plasticulture development centres to promote the use of plastics in agriculture.

The report said in the case of synthetic fibres not only has the country achieved self-sufficiency but is also in a position to export significant quantities of it.

The report said the Department has been endeavouring for the orderly planned growth of high quality drugs and pharmaceuticals and chemicals in order to ensure self-sufficiency in indigenous availability and also encourage their exports.

For achieving this project, one of the plans has been to streamline some of the regulatory procedures and to usher in a regimen of liberalisation.

The three-pronged strategy adopted to implement the policy liberalisation in industrial licensing procedure over the last three years had been delicensing of items of manufacture, broadbanding of similar items and stipulating minimum economic plan sizes.

Under the measures seventeen groups of chemicals and ninetyseven items of drugs have been delicensed -- broadbanding had been permitted in synthetic fibre industry as well as twentyeight groups of chemicals for promoting better utilisation of existing plant capacities and allowing flexibility in product range for meeting emerging market demands.

IMPORT DUTY ON IBUPROFEN

US co. plea against Cheminor rejected

The US Administration has turned down a plea by Ethyl Corporation, an American chemical and pharmaceutical conglomerate, for slapping import duty on ibuprofen bulk drug exports of Cheminor Drugs Pvt. Ltd. of India.

Ethyl, in its petition, had accused Cheminor of selling the product at dumping price and threatening American producers of the drug. The production facilities of Cheminor are certified by the US Food and Drug Administration.

Cheminor Drugs of Hyderabad belongs to the Dr. Reddy's group of companies, which pioneered the export of alpha methyldopa and ibuprofen to the US. While most drug exports attract a seven per cent duty under the general system of preference (GSP), ibuprofen has enjoyed duty-free entry on the ground that India is an ''underdeveloped country''.

Cheminor has contested Ethyl's contention that it is responsible for lowering the price of ibuprofen in the US market. According to a company spokesman, it is a ''fear psychosis created by Ethyl''. If it is true that US producers are losing out to Indian companies, Ethyl would not have embarked on expansion of their ibuprofen capacities, he said.

Rich tributes

Unwittingly Ethyl has paid glowing tributes to Indian industry in its petition which said Cheminor Drugs as well as other Indian raw material manufacturers are equal in their capabilities and can match the best in the world. ''India is certainly not ''underdeveloped'' in the pharmaceuticals field. It is perhaps the only Third World country where new generation products are made from the basic stages without any technology tie-ups with western firms''. Cheminor will continue to enjoy a price advantage over US producer even if the White House decides the case in favour of the US firm through its profitability will be eroded.

''We have experimented and commercially made products by newer routes, often resulting in purer products than what the discoverers are able to achieve'', says Dr. Anji Reddy, Chairman of the group.

Globe Organics, a group company, commissioned its ranitidine (anti-ulcer drug) plant last year, becoming the only Indian company to make it from the basic stage. It follows a synthetic route quite different from that of Glaxo, UK, who discovered the drug. Other drugs made by the group include ampicillin, cephalexin, minoxidil (the ''hair-raising drug''), Naproxen, norfloxacin and sulphamethoxazole.

The group proposes to increase its turnover from Rs. 40 crores, of which Rs. 15 crores came from exports, in 1988 to Rs. 100 crores in the next three years. About 75 per cent of the projected turnover will come from export. The target will be met by increasing the range of bulk drugs to include bitiazen enalapril, fenoprofen, omeprazole, gemfibrozil and other new generation drugs which are in demand all over the world. Exports will also cover intermediates like di-naproxen and ADCA. The company also plans to diversify into fermentation products.

To achieve these objectives, the group is acquiring 300 acres of land in a coastal area in Andhra Pradesh. To meet the increasing requirement of funds, the company will come out with a rights issue in the ratio of 1:2.

Local production halted

Ibuprofen is in news at home too with firms like Glindia, Boots and Cipla having stopped production of this anti-inflammatory, arthritis and analge drug. Industry sources attribute this the Government's sudden decision halve the drug price from Rs. 800 Rs. 400 a kg.

The decision (based on the invoic copy attached to submissions by a un to the Bureau of Industrial Costs an Prices showing it had bought the dru at around Rs. 400 a kg) has upset th industry. This goes against the Govern ment's accepted principle of fixing prices on cost basis. If the market price is to be the criterion, the Goverment should logically allow price increases too based on market fluctuations. The industry has excess capacity for this drug and some small units in the South have been selling at unremunerative prices.

This is the second occasion in recent times when the Government has cut price on an ad hoc basis without reference to cost of production. Earlier, rifampicin price was slashed because the public sector Indian Drugs and Pharmaceuticals Ltd. imported a consignment at a price lower than that fixed in this country. Meanwhile, the Department of Chemicals and Petrochemicals is likely to recommend to the Finance Ministry further reduction in import duty on drug intermediates and also to rectify the anomalies that persist in the duty structure despite Government's commitment to rationalise the same.

MoU WITH USSR FOR CITRIC ACID PLANT

A memorandum of understanding (MoU) for setting up a citric acid plant in India has been signed between the Universal Telelinks Ltd. and the State Agro-Industrial Committee of the USSR. The plant will be set up in Maharashtra with a capacity of 5,000 tonnes per year. According to the agreement, the Soviet side will buy back a certain percentage of the total production.

Drugs: BICP for further liberalisation

The Bureau of Industrial Costs and Prices (BICP) has called for further liberalisation in the drug industry by moving a number of important controlled bulk drugs from administered price control towards one which is tariff-based.

A committee headed by the BICP Chairman, Dr. Vijay Kelkar, in its supplementary report on category two drugs, has suggested removal of constraints, including administered price control to promote the growth of the drug industry.

The Committee noted that one of the major constraints faced by the Indian drug industry is the delay in implementing the administrative price controls. The controls are slow to respond as the administered prices are not revised when the input costs rise. Lags in correcting producers' prices means that the production becomes progressively unremunerative and impedes production as well as expansion. The consumers also suffer due to non-availability of new drugs which have replaced old drugs abroad.

The Kelkar Committee proposed moving a number of bulk drugs from the administered price control mechanism towards a price control mechanism which is tariff-based while retaining selective administered price control on their formulation if it is necessary to curb producers' monopoly.

The Committee also recommended that in order to minimise the consumer prices, the effective rate of protection in the bulk drug sector be progressively brought down so that it does not exceed 40 per cent. This level recognises that scarce foreign exchange alongwith large-scale purchases from India could potentially push up the import prices.

The BICP Committee also suggested price control exemption for new delivery systems to ensure better efficiency and lesser side-effects. Unless these technologies of recent origin are adopted in the country, the people would be deprived of these benefits. The Drug Controller of India may be asked to identify the drugs that come under the new delivery system.

The Committee felt that such formulations based on the new delivery systems should be kept outside the purview of price control for at least five years.

It observed that at present the duty component on certain items used in the testing and analysis of drugs and pharmaceuticals is very high. The quality of drugs is of utmost importance, and in order to encourage setting up of testing facilities in each and every drug manufacturing unit, the Committee recommended that the following equipment be allowed duty-free entry: Ultraviolet spectrophotometer, infra-red spectrophotometer, gas chromatograph and high-pressure liquid chromatograph.

Several pharmaceutical firms have created facilities for research and development work. However, only a few have carried out fundamental research work for the discovery of new molecule as a chemotherapeutic agent, and screening the existing molecules for other indications. The present practice provides little incentive to reduce cost, while the outcome of high R and D expenditure is uncertain.

Hence the Committee suggested that the Government consider 50 per cent of the reduction while fixing the price. The other 50 per cent should be allowed to be retained by the company.

It also suggested duty reduction for capital equipment needed for research, development and quality control purposes. The Committee reiterated its earlier recommendation for reduction of price at the consumer level so that the weaker sections of the society have access to health care. For a reduction in prices at the consumer level it would be necessary to take fiscal measures at the Central and State levels.

It expressed satisfaction over the steps taken by the Government in this direction for removal of excise duties on all important non-scheduled ones. The list of such drugs could be prepared by the Health and Family Welfare Ministry for removal of excise duties.

The Committee also proposed subsidies for the drugs required for longer period therapy and largely used by the poorer sections. The Kelkar Committee noted that after the Drug Price Control Order (1987) was implemented, further action is required to enable the drug industry to expand in the right direction to serve the domestic consumers and capture a growing part of the world trade.

The total world trade in pharmaceuticals is $57 billion and is growing rapidly. There are newer markets in the world and this would enable the Indian industry to expand its exports, which would result in economies of scale in production.

HOC'S EXPORTS DOUBLE IN '88-89

The export of chemicals by the Hindustan Organic Chemicals Limited (HOC) doubled during 1988-89, touching Rs. 13.75 crores compared to Rs. 6.48 crores in the previous year. An official press release said, HOC exported nearly 1,000 tonnes of phenol and 5,000 tonnes of acetone for the first time. Exports were made to West Germany, Britain, the United States, France and Japan. The export target for 1989-90 has been fixed at Rs. 30 crores of chemicals, the release said. HOC's Cochin unit, commissioned in 1987 with installed capacity of 40,000 tonnes of phenol, and 24,000 tonnes of acetone, has a utilisation rate of 96 per cent.

YDROGEN PEROXIDE PROJECT

Du Pont poses new condition

Du Pont has refused to go ahead with Rs. 32-crore hydrogen peroxide pro-ct with the Thapars unless the gov-hment reviews the provision of solute liability enforced on Shriram od and Fertiliser Inds. for the oleum as leak.

The Supreme Court judgement has ied that the companies will be strictly nd absolutely liable to compensate ose who are affected by incidents lated to hazardous activties. Equally nportantly, the Supreme Court has laid own the principle of punitive damages nd ruled that compensation payable to ne victims should be related to the abil-y of the enterprise to pay and not the bility of the victims to earn.

As Du Pont is a Rs. 40,000-crore onglomerate and intends to have an quity participation in the project along vith the Thapars, the provision of abso-lute liability has forced some rethinking about the venture.

Du Pont claims that the liability clause should cover only the project concerned and not Du Pont itself.

The liability ruling has become a major irritant in the way of bringing equity participation by foreign companies in chemical and related fields. Many multinationals have refrained from coming into the country on account of the provision it is learnt.

DESALINATION PLANT FOR MADRAS

Titanium Equipment and Anode Manufacturing Company Limited (TEAM), has introduced purified clean drinking water to suit the common man's need in the city. Water is now available in sachets containing 300 ml of water, priced at 50 paise.

Polyamide membranes are used to remove excessive hardness from the sea water and to purify it. This water is further disinfected using ozone making the water bacteria-free. The water is then packed in sachets by a hygienic, automatic process.

TEAM's pure water division has for the past one year, put in a lot of efforts to solve the drinking water problem in Madras. A sea water desalination plant at Madras converts sea water to drinking water and also helps to conserve water.

The water from this plant is far superior even by WHO standards which prescribes water with TDS (total dissolved solids) of 1000 ppm as fit for drinking purposes, claims the company. Out of the required 150 lt of water per day, Madras is able to provide only 50 lt per capita per day to its citizens.

IDMA against joining Paris convention

The Indian Drug Manufacturers Association (IDMA) has requested to the Prime Minister not to succumb to pressures compelling India to join the Paris convention on patents.

Recalling how the late Prime Minister, Mrs. Indira Gandhi, enacted the Indian Patents Act of 1970, the IDMA President, Mr. N.I. Gandhi said the Act had ushered in an era of technological revolution that had transformed the Indian industrial scene during the last two decades.

In fact, it is the very success of the Indian Patents Act and subsequent developments which has resulted in such an enormous pressure on India to yield and hence the current round of intensive lobbying establishing beyond doubt that in such a short span of time, India is emerging as a technological force to penetrate the world market. Even those who support the demand that India should accede to the Paris Convention, admit that this can have a disastrous impact on India's booming chemical and pharmaceutical exports. They are also unanimous that India should not be a party to a one-sided and discriminatory treaty which bestows little rights on the signatory, but gives unlimited powers to the patent holder.

In his communication, Mr. Gandhi pointed out that continuation of the existing patent law will foster the competitive environment, nurture technological development and also help the Indian consumer get the best value for money. "In fact, this phenomenon is already existing in the pharmaceutical industry and the prices are ruling five to ten times lower than anywhere in the world."

The pharmaceutical industry worldwide does not have, in a true sense, a competitive environment as large transnationals operate in an oligopolistic system of monopoly of product patent for about 20 years. Because of this, the consumer in the West pays as muc 10 to 12 times more for his medic Mr. Gandhi contended that at the rent stage of development, when h amenities are not reaching everyon is important that we must protect health of our people. He urged the G ernment to consider the following w negotiating under the auspices GATT: Protection of existing envir ment of providing technological fr dom to develop and innovate withi reasonable legal framework; main nance of the competitive environm which stimulates technological advan ment as well as ensures a fair price the consumer and the creation of a c ture of research and technology to pr vent future brain drain and provision opportunities for Indians abroad return to the country.

In conclusion, he said that "the spir of the Indian Patents Act 1970, need be preserved, to ensure that medicine are available to the people at a pric which is the lowest in the world".

Rs. 15 cr. aspirin project inaugurated

The Rs. 15-crore aspirin project at zhakkoottam near Trivandrum, fully ned by the Kerala Government was ugurated by the Chief Minister, . E.K. Nayanar, on April 18.

The plant with a capacity to produce 00 tonnes of aspirin, 1000 tonnes of licylic acid and 260 tonnes of sodium licylate per annum will commence ommercial production by June next.

rocess Technology

Perfected by the collaborators in the ISA, the process technology features uch modern concepts as continuous pray-drying and Crystallisation, High-ressure Reactions, elimination of the se of solvents & major disposable tems, etc.

A modern recovery facility has been ncorporated for effective recycling of ecovered material, thus ensuring a high legree of process safety, efficiency and urity of end-products.

The plant has a full-fledged effluent reatment facility. Treated water con-orms to the stringent specifications pre-scribed by the Kerala State Pollution Control Board. This facility has been installed on modern lines at a cost of Rs. 25 lacs.

Safety

Top priority has been given to this aspect by way of provision of in-built safety controls in the factory. The plant has been provided with flameproof equipment in the process buildings. Staff has been given training in safety by way of class-room discussions and later, on-the-job as well. Besides, in relevent areas, obnoxious vapours are being continuously evacuated.

According to the Kerala Industry Minister, Mrs. K.R. Gowri, the project would provide direct employment to 250 persons. In view of the scope for ancillary units, the project could indirectly employ many more, she added.

Mrs. Gowri stated that to begin with only 50 per cent capacity would be utilised. But in three years time, the full capacity would be utilised, she added.

The share capital of the company was to the tune of Rs. 63 crore. The IFCI, IDBI and the State Bank of Travancore had provided the institutional finance for the project, she informed.

Kalama Chemicals and Norvic Eaton Pharmaceuticals, both US-based are the technical collaborators. Kinetic Technology India Ltd. have provided the engineering consultancy, she said.

The minister said that there was good demand for aspirin in the Indian as well as in the international markets. The demand had gone up lately with aspirin being widely used as a cardio vascular drug.

The present production of aspirin in India was 2300 tonnes. But the demand in the country was for 3165 tonnes. Besides being the most wellknown household remedy as an analgesic, anti-pyretic & anti-inflammatory drug, the medical profession is now accepting its new-found use as a life-saving drug in the alleviation of cardiac disorders.

The company is preparing for its marketing set-up in India as well as in the International markets and is working on steps to diversify into other related drugs and formulations in appropriate phases.

According to Mrs. Gowri, there was also scope for exports of the product to countries like Japan, United States and West Germany. The export market would also be tapped in future.

The company also has an expansion plan at a cost of Rs. 10 crores which would be implemented over a period of eight years.

Radiation Sterilization plant commissioned

Radiation sterilization using gamma radiation from radioisotope sources is by now well established as a very efficient and convenient technique for achieving a high sterility assurance level in disposable medical products. Over one hundred and fifty commercial plants are in operation all over the world using this technique. ISOMED, a radiation plant for the sterilization of medical products, set up by the Department of Atomic Energy in Bhabha Atomic Research Centre at Trombay with the assistance of the United Nations Development Programme, is in operation since 1974. The second Radiation Sterilization plant in the country -- RASHMI installed in the premises of Kidwai Memorial Institute of Oncology, Bangalore is the outcome of joint efforts of the Kidwai Memorial Institute of Oncology and BARC, Bombay. This is the first of its kind in design and is totally indigenous. It will cater to the needs of the hospitals and industries in South India. Radiation Sterilization is a simple and safe process involving the exposure of products to gamma radiation from a cobalt-60 source, for a predetermined time so as to receive a prescribed dose.

This plant with a capacity of 300 kilocuries cobalt-60 can process 6000 m^3 of medical products (0.15gm/c.c.) annually. The product boxes in suspended aluminium containers are conveyed past a central source rack. Each conveyor has two shelves, and the product boxes are automatically transferred from one shelf to the other using a series of pushers, operated hydraulically.

Each product box is approximately 600 x 500 x 900 mm and can accommodate 4 cartons of dimensions measuring 285 x 485 x 440 mm. The loading, unloading and transfer of product box is carried out outside the concrete shield. The sterilized medical products are automatically conveyed to an isolated area for despatch thus avoiding any human error. The radiation source comprising of cobalt-60 rods in doubly encapsulated stainless steel pencils is stored under 5.6 metres of water in a storage pool inside the concrete cell when not in use.

Products commonly sterilized by radiation include absorbent cotton wool and absorbent gauze products, pharmaceuticals including absorbable gelatin sponge, bentonite powder, charcoal powder, fluorescein sodium (as strips), gelatin capsules (empty), ophthalmic ointments in paraffin base such as atropine sulphate, chloramphenicol, gentamycin sulphate, tetracycline, chloramphenicol (in soft gelatin capsule), ophthalmic preparation in an oil base like quinapyramine chloride and sulphate (for vet. use), skin ointment in polyethylene glycol base as for example, neomycin sulphate, hydrocortisone acetate, alphachymotrypsin, plastic and rubber items, sutures (with or without needles) etc.

Benefits of radiation sterilization

1. Flexibility in packaging as the products can be packed individually in sealed bags and sterilized in the fully packaged form.
2. Since sterilization is effected after final packaging, product sterility is retained indefinitely i.e., upto the point of use, provided the package is undamaged.
3. Complete sterilization of products of any shape because the powerful gamma rays penetrate right through the products and package.
4. Being a 'Cold' process heat sensitive medical products made of plastics can be safely sterilized.
5. Radiation sterilization is a continuous, fully automated process with only a single parameter to be controlled namely time of exposure.
6. Availability of ready-to-use prepacked, presterilized products.
7. Products sterilized by this process do not become radioactive and are safe for use. The most reliable method of sterilization with a high degree of ste ization quality.

Packaging

The packaging should provide complete barrier to the entry of micr organisms and should be designed facilitate asceptic removal of the co tents. The materials to be radiation ste ilized are packed in impermeable film such as polyethylene, cellophan -polyethylene or paper-polyethylen laminates, which can be heat sealed thu ensuring maintenance of sterility. Thes laminates have good tear and impac strength, have customer appeal and ar inexpensive. Other types of lami nates can be designed for convenience and to suit the product. Unsupported polyethylene films of 300 gauge thickness are suitable for soft products and of 500 gauge for rigid products.

Product sterility

Gamma radiation is very effective in inactivating micro-organisms. As the bacterial counts of each item should be as low as possible, products should be handled as little as practicable in the course of manufacturing process. Premises should be clean and dry, ventilated with clean air, and the construction and furnishings conducive to regular and thorough cleaning. A minimum radiation sterilization dose of 25 KGy is employed for medical products as in most of the countries. This dose provides an extremely high safety factor, and when the product also has a low initial microbial count, the probability of any microbial survival can be expected to be less than one in one million.

Radiation sterilization plant services

RASHMI shall offer a regular irradiation service guaranteeing a minimum dose of 25 KGy to medical products. RASHMI has also built up expertise in the following areas: material selection, advice on packaging, advice on manufacturing hygiene, microbiological testing (on random sample), product development, tissue Bank, and research and development.

Record production at HPCL refineries

Hindustan Petroleum Corporation Ltd. (HPCL) refinery at Bombay after achieving a 100 per cent capacity utilisation registered the highest-ever crude processing of 5.5 million tonnes for 1988-89 with its Vizag refinery processing touching an all-time high of 3.76 million tonnes resulting in a combined output of 9.26 million tonnes.

In a statement, HPCL said reduction in fuel consumption and loss from 6.7 per cent to 5.4 per cent has resulted in a net saving of Rs. 26-crore worth of foreign exchange. Both Bombay and Vizag refineries have been reducing fuel consumption and increasing crude production.

During the year the HPCL refineries maximised yields of high value products and achieved record levels of production of motor spirit, kerosene, ATF, HSD, bitumen and low viscosity index oil. Both refineries produced 438,000 tonnes of ATF (aviation turbine fuel), which is 25 per cent of the country's production.

The statement said that motor spirit production touched an alltime high of 430,000 tonnes at the refineries with Vizag refinery producing nearly half a million tonnes of kerosene.

The entire requirement of edible oil industry for hexane was met by Bombay's refinery which produced a record 45,000 tonnes.

HPCL handled 60 per cent of the total volume of LPG imported during the year to meet the consumer demand with the Vizag refinery handling 97,000 tonnes of LPG imports through 19 tankers, the statement added.

In order to achieve product diversification, increase capacity utilisation and reduce energy consumption, several projects are under various stages of commissioning.

The captive power plant at the Bombay refinery which is ready for commissioning will generate the required power for the refinery. The plant is estimated to result in the saving of Rs. 16 crores per annum besides releasing additional power to the State grid, the statement added.

To augment lube production a detailed project report has been submitted to the Government. Projects for the production of propylene and LAB feed-stock used for detergent manufacture are under way at the Vizag refinery.

During the year the Vizag refinery completed nine million manhours and the Bombay refinery two million manhours without loss of time or injuries, the statement added.

RS. 1,200 CRS IN INVESTMENT ENVISAGED: ONGC PLAN TO DEVELOP GANDHAR FIELD APPROVED

The Petroleum and Natural Gas Ministry has approved an ambitious plan to develop the Gandhar oil and gas field in Gujarat, envisaging a total investment of over Rs. 1,200 crores in the next five years.

A high-level meeting convened by the ministry at New Delhi on April 19, discussed the main features of this plan and approved it in principle. The meeting was attended among others by Planning Commission officials and representatives of the Oil and Natural Gas Commission (ONGC).

The five-year plan will be implemented by ONGC to raise crude output to three million tonnes and gas output to 10 million cubic metres per day by March 1995. Of the total envisaged gas output, six million cubic metres per day (mcmd) would be associated gas and four mcmd would be free gas. ONGC has now been asked to go ahead with its production of crude oil and gas from Gandhar fields, for which an investment of about Rs. 230 crores has already been cleared. This would raise the total oil output to one million tonnes and gas output to 1.5 mcmd by the end of March 1990.

The detailed plan for the remaining years till March 1995, will be worked out by ONGC. The petroleum and natural gas ministry has stipulated that ONGC should submit its plan by June-end this year. Subsequently the plan would be taken up for consideration by the Public Investment Board and the Union cabinet.

The proposed investment of Rs. 1,200 crores would mainly be on deployment of rigs, drilling and production operatons, construction of surface structures and construction of pipelines to carry the gas and crude to the user-points. According to the plan, 4 rigs are to be deployed by the end of March '90.

The plan for utilising the gas to be produced from the Gandhar field has also been finalised. The major consumer would be a 600-mw gas-based power plant, to be put up in Gujarat. The remaining gas would be fed into the HBJ pipeline. Necessary spur lines to connect the gasfield to the pipeline would also be constructed. This is also included in the Gandhar development plan.

An alternative plan for utilising the gas to be produced from the Gandhar field is also under the govt.'s consideration. The state-owned Indian Petrochemicals Corporation Ltd. (IPCL) has proposed that it be allowed to remove ethane and propane (C2 and C3) from the natural gas produced at Gandhar and use them for production of ethylene.

The additional availability of ethane and propane would help IPCL raise its ethylene output from 130,000 tonnes to 250,000 tonnes per annum at its Vadodara plant. A separate proposal to raise its ethylene capacity depending on the gas availability is being formulated. The gas requirement for an ethylene capacity hike of this order would be about 5 lakh cubic metres per day. The Gandhar oil and gas field is one of the rich discoveries of ONGC. The total area is around 950 square kilometres and the reserves are estimated to be 45 million tonnes of oil and 75 billion cubic metres of gas. The ministry's decision to go ahead with the development plan by ONGC means that there is no possibility of the Gandhar field being thrown open to the private sector on lease.

Chavan rejects small units plea on excise

The Union finance minister Mr. S. B. Chavan, rejected the small industries' plea for restoring the pre-budget excise exemption granted to small-scale units manufacturing any two items falling within a particular category of the Central Excise Act.

Prior to this year's budget, small industries were allowed excise exemption upto a level of Rs. 15 lakhs each for any two items produced under a particular heading of a chapter in the Act. The Act contains 92 chapters, each of which has numerous headings pertaining to manufactured items. Under this year's budget, the excise concession is allowed only for any one item produced under a particular heading.

Earlier, if, for example, a manufacturer produced a plastic cup and a plate, he was entitled to excise exemption of up to Rs. 15 lakhs on each of these items. Now this concession will be limited to only one item. If, however, the manufacturer were to make another item, falling say under the heading of "copper", he is entitled for excise exemption, but again for one item only.

The finance minister, who met a delegation of small scale units under the aegis of the Federation of Associations of Small Industries of India (FASII) and the Federation of Delhi Small Industries Association, said that it would not be possible to restore exemption by "headings". He felt that any increase in exemption limit was likely to be misused and exploited by the large scale sector.

According to a FASII release, the minister was, however, sympathetic to the appeal for enhancing the general exemption limit allowed for the small scale units from Rs. 15 lakhs to Rs. 50 lakhs. The small scale industries felt that it was imperative to do so in view of the tremendous increase in the cost of inputs. Mr. P.B. Duggal, president, FASII, explained that while the minister did not give any assurance regarding the exemption limit, he told the representatives that he would be meeting them shortly, where his officers would be present to sort out the various problems. Mr. M.R. Gupta, president, Federation of Delhi Small Industries Association, had earlier urged the finance minister to exempt the footwear industry from excise duty by enhancing its limit from Rs. 60 to Rs. 75. The steep increase in input costs, he said, made it difficult for SSI units to produce footwear within the specified excise limit.

PLEA TO PERMIT PHOSPHORIC ACID IMPORT

A plea to permit imports of phosphoric acid under OGL to selected manufaturers of DAP is understood to have been made by the fertiliser industry to the Union Ministry. Units like Paradeep Phosphates Ltd., Hindustan Lever Ltd., Godavari Fertilisers and Chemicals Ltd., (GFCL), Gujarat State Fertiliser Corporation - Sikka and IFFCO - Kandla produced only phosphatic fertilisers based entirely on imported phosphoric acid and have had to close down with serious impact on their financial viability, it was stated.

These manufacturers should be permitted imports under OGL at reasonable prices, say upto $ 5 to $ 10 per tonne, less than the amount finalised during the negotiations with the foreign suppliers. The Fertilisers Association of India (FAI) in a communication to the Union Fertiliser Minister, Mr. R. Prabhu is understood to have expressed its concern at huge loss of production in the DAP manufacturing units.

While appreciating and supporting the government stand not to allow exploitation by the cartel of suppliers trying to dictate their own prices, the association is stated to have drawn government attention to significant financial loss to industry by way of fixed costs and also loss of profitability. In this context, the industry is understood to have requested the government to ensure that the affected units are compensated for the resultant loss. This would also help forcing the issue of reasonable price with the cartel.

IEL TAKE OVER OF NALCO CHEM APPROVED

The green signal has been given for IEL's take-over of Nalco Chemicals India Limited. The IEL will invest Rs. 200 lakhs in Nalco by purchase of 20 lakh equities of Rs. 10 each, equivalent to 40% (par value) of fresh issue. IEL is engaged in the manufacture of Alfloc, commercial blasting explosives, gypaermethrin, detonators, dyes, heat treatment salts, liquid insecticides, military powder, nitrocellulose polyester staple fibre, pharmaceuticals, pretreatment chemicals etc.

The investee company Nalco was promoted by the IEL in collaboration with Nalco Chemicals of USA in 1987 for the manufacture of 11,000 litres per annum of speciality chemicals for industrial applications. The project cost of Nalco will be met inter alia by the issue of equity worth Rs. 500 lakhs out of which the IEL will be subscribing Rs. 200 lakhs (40%) and of the balance 60% the foreign collaborators will subscibe 40% and the remaining 20% will be offered to the general public. The Centre's order says that the take-over of Nalco by IEL was in public interest.

CHEMASIA '89

Three highly specialised shows -ChemAsia89, InstrumentAsia89,and AnalabAsia89 will be held in Singapore from May 23 to 26, accompanied by two conferences on "Process plant: engineering, control and management" and the AnalabAsia conference, focussing on analytical tech. for the 1990's.

A rapid wrap-up of what's new in Operations, Processes and Products

SEPARATION PROCESSES

Modern packings for distillation and absorption

Billet and MacKowiak have given an exhaustive account of this subject and topics include pressure drop, mass transfer data for distillation and absorption, liquid distributors, etc. A variety of random and regular packings made from sheet metal, wire gauge, etc. have been considered. There are distinct advantages in changing over from plate to packed tower as this not only results in lower pressure drop but it can also provide for higher number of theoretical stages in the column. If a proper liquid distributor is used then column diameter can be quite large and efficiency is maintained. In a typical new distributor the number of streams could be 1200 to 2400 per sq. m. of column cross section.

For absorption plastic packings can be quite advantageous and as the time passes the wetting improves. (*Chem. Eng. Technol.* 1988, **11**, 213-227).

Electrochromatography (EC)

Electrophoresis employs an electric field gradient to drive the separation of charged molecules. Scale-up problems exist due to non-uniform heating, electrically induced flow, lack of speed etc. Rudge and Ladisch have covered this subject which represents the combination of a sorbent-based separation and as electrical gradient in a comprehensive way. Reports of EC separations are beginning to increase. (*Biotechnology Progress* 1988, **4**, 123).

A related paper by Locke and Carbonell as counteracting chromatographic electrophoresis may be referred. (*Sep. and Purification Methods* 1989, **18** (1), 1-64).

Scaling rules for isocratic elution chromatographs

Wankat and Koo have developed scaling-up rules for elution chromatography where they envisage the use of smaller dia particles with high mass transfer rates and the column length, diameter, and cycle time are then scaled so that pressure drop, separation and throughput are the same or better than in the old design. It is interesting and potentially useful to find that the new design uses much less packing and cycles more rapidly than the old design. (*A.I.Ch.E. Jl.* 1988, **34**, 1006).

Continuous, Regenerative, two-dimensional extraction

Wankat and co-workers have discussed experimental and theoretical aspects of using several variations of regenerated, two-dimensional cascades. Shifts in temperature were used to regenerate the solvent from the systems diethylamine, toluene, water and citric acid, 55/50 toluene-triisooctylamine, water. (*Ind. Eng. Chem. Res.* 1988, **27**, No. 4, 650; 1886).

Separation and optical resolution by inclusion complex formation

Tanaka and Toda have used inclusion complex formation for separation and optical resolution of a wide variety of organic compounds. Similarly, water soluble inorganic and organic compounds were isolated from aqueous solutions. Some aspects of designing, some new chiral host compounds have also been discussed. (*Nippon Kagaku Kaishi* 1988, No. 10, 1643).

Scale-up of bioseparations for microbial and biochemical technology

Ladisch and Wankat have discussed the use of centrifugation, filtration, ultrafiltration, adsorption and chromatography as important unit operations for separations involving biological molecules. A number of examples are presented and these include: throughput of a disk centrifuge; broth clarification using a biological processing aid; microfiltration of yeast cells; product concentration using a radial flow cartridge; constant pattern adsorption; linear chromatography; and staging strategies for maximising chromatography column throughput. (L and W in the Impact of Chemistry on Biotechnology, M. Phillips *et. al.*, eds, ACS, 1988, p. 72-101).

Use of electric fields in solvent extraction

T.C. Scott has given an exhaustive account of this subject and delineated future prospects. The process can be operated in the "insulating-phase-continuous mode". The formation of droplets from nozzles and orifices requires attention; formation of micron-sized emulsions via electric field dispersion represents an area of promise. Coalescence of electrified droplets is already of practical value. (*Sep. Purification Methods* 1989, **18**, No. 1, 65-109).

Solubility of ozone in some fluorocarbon solvents

It is well known that oxygen has remarkably high solubility in some fluoro solvents and the highest value reported to date is 57.2 ml O_2/ml of solution at 25°C and 1 atm. In the case of ozone (6% concentration in gas), the solubility in $C_2F_3Cl_3$ + 60 wt % $C_4F_4Cl_4$ is as high as 57 ml/100 ml of solvent; even 1,1,1 trichloro ethane shows a value of 13.3. (Brabets, R. *et. al., J. Fluorine Chem.* 1988, **41,** 311-320).

Side reactions in nitrosation of phenol

Kamalova *et al* have shown that nitrosation of phenol with nitrous acid gives only 75-85% yield of *p*-nitrosophenol at almost 100% conversion of phenol. It seems that the *o*-isomer gets rapidly converted to the corresponding diazo derivative. If the excess of sulphuric acid is increased from 0.7 to 3.0 moles per mole of phenol, the amount of *o*-azoderivative is reduced by a factor of 8 compared with *p*-diazoderivative. (*J. Org. Chem.*, USSR, Engl. Trans, 1988, 24(5), 1004-1005).

Catalytic effect of sodium carboxy methyl amylase (NaCMA) and hydrolysis of esters

Jiang *et al* have shown that NaCMA catalyses hydrolysis of N-lauryl-3-acetoxypyridinium iodide and *p*-nitrophenol dodecanoate, at pH of 7.32 to 9.30; the enhancement depends on the degree of substitution. (*J. Phy. Org. Chem.* 1988, **1,** 143).

Titanium silicalite (TS) catalyst for conversion of phenol with H_2O_2 to catechol and hydroquinone

Kraushaar-Czarnetzki and Vanhooff have used TS, which has structural features of ZSM-5 with Al replaced by Ti, for the reaction between phenol and H_2O_2 in methanol medium. The selectivity of the catalyst is affected by the presence of small amounts of non-framework titania. TS prepared by the modification of (Al) ZSM-5 exhibits the same catalytic properties as hydrothermally synthesised TS of high purity. (*Catalysis Letters* 1989, **2,** 43).

Fischer-Tropsch (FT) synthesis with supercritical (SC) phase

Yokota, K. and Fujimoto, K. have shown that with *n*-hexane as the SC phase, in a fixed bed reactor, the removal of reaction heat and waxy product from the catalyst surface was greatly facilitated. The SC phase reaction produced more C_{25}+ compounds than reactions in either liquid or gas phase. (Fuel 1989, **68,** 255-256).

Mass transfer behaviour of gas-liquid jet loop reactors

Jet loop reactors (JLR) are by now well known as they provide exceptionally high values of overall liquid side mass transfer coefficient (LSMTC) and gas-liquid interfacial area. Warnecke *et. al.* have given a very useful account of this subject with two JLR of 9.05 and 74 litres. LSMTC values were measured by desorption of dissolved O_2 (from air) in water with nitrogen; CMC solutions were also used. It is truly remarkable that exceptionally high values of LSMTC, approaching 2.2 $second^{-1}$ were realised; fractional gas hold-up approached 0.23. Electrolytes increase the value of LSMTC. (*Chem. Eng. Technol.* 1988, **11,** 306-311).

Microbial and enzymatic processes

Yamada and Shimuzu have given an exhaustive account of this system which exhibits high specificity at ambient conditions. A microbial transformation is the conversion of one substance (substrate) to another (product) by a microorganism. High catalytic efficiency is characteristic of such reactions and, for instance, the rate of hydrolysis of an amide by chymotrypsin is about 4000 times higher than that for the corresponding base catalysis. The conversion of porcine insulin into human insulin is an interesting example; L-tyrosine and L-Dopa with bacterial ß-tyrosinase are other examples. The combination of synthetic and enzymatic process is illustrated by the case of racemic lysine obtained via reaction of cyclohexene and NOCl.

MICROEMULSIONS

Alcohol free microemulsions (ME)

ME are used in topicals but short chain alcohols like 1-pentanol which are comonly used are skin and/or eye irritants. Osborne *et. al.* have made ternary and pseudo-ternary water/hexadecane/dioctylsulfosuccinate (DSS)/sorbitan laurate ME. (*J. Disp. Sci. Tech.* 1988, **9,** 415).

Oil in PEG/water emulsions

Maglassi has prepared such emulsions which have potential applications in the pharmaceutic and cosmetic industries. It was found that for all PEG's, the droplet size decreased with decreasing water concentration, until a fast phase separation was observed. (*ibid,* p. 391).

Segregation and chemical conversion at oil-water interface

The oil-water interface can attract and collect dissolved and suspended matters and hence is potentially impor-

tant in separation and reaction engineering. Ganesan *et al* have shown that dissolved and suspended materials can be segregated into a compact emulsion in between water and an immiscible oil phase and that such segregation facilitates the separation or conversion of the materials. (*Chem. Eng. Sci.* 1988, **44,** 171).

A novel paired electrosynthesis of *p*-benzoquinone and hydroquinone

The synthesis has been realised by Ito *et al* through a combination of anodic oxidation of benzene on PhO_2 electrode with "cathodic oxidation of benzene" using Cu(I)/Cu(II) mediator in a single H-type cell. Total current efficiency was 94%. (*Tetrahedron Lett.* 1989, **30,** 205).

Dehydrogenation

Optically active beta-amino-alpha phenylethanol derivatives are important chiral building blocks for the syntheses of useful biologically active compounds. Takeda *et. al.* have reported efficient asymmetric hydrogenation of alpha-aminoacetophenone derivatives with the neutral (2S, 4S)-MCCPM-Rh complex. Example of S-(-)-levamisole is reported. (*Tetrahedron Lett.* 1989, **30,** 363).

Enantioselective lipase-catalysed hydrolysis of esters of epoxy secondary alcohols

Marples and Rogers-Evans have shown that as an alternative to Sharpless epoxidation the lipase catalysed hydrolysis can be conducted. (*ibid,* p. 261).

Cyclic sulfate esters

Sharpless and Giao have shown that cyclic sulfites, obtained by the reaction of 1,2 diols with thionyl chloride, on oxidation with sodium periodate with Ru catalyst, gives the corresponding sulphates. Asymmetric dihydroxylation of olefins has already been achieved and these optically active cyclic sulfates are now possible. (*J. Amer. Chem. Soc.* 1988, **110,** 7538).

Calculation of simultaneous chemical and phase equilibria in nonideal systems

Fredenslund *et al* who have done some pioneering work in this area, have now come out with a new method which takes care of several complications. Illustrations are of industrial importance: Xylene isomerization; Methyl-*tert*-butyl ether production; Esterification of ethanol with acetic acid; Propene hydration; Methanol synthesis. (*Chem. Eng. Sci.* 1989, **44,** No. 2, 237).

SELECTIVE SYNTHESIS

Asymmetric synthesis of alpha-hydroxy ketones (AHK) using PTC

Masui *et al* have reported a novel synthesis of AHK using chiral PTC in a two-phase system, where oxidation of achiral ketones is carried out with oxygen. 2-Alkyl tetralones and indanone were oxidised in good optical yields; quaternery ammonium salts derived from cinchona alkaloid were used as PTC. Ion pair formation between the chiral PTC and ketone is probably responsible for the observed results. (*Tetrahedron Lett. 1988,* **29,** 2835).

Enantioselective reduction of ketones on sterically-controlled lanthanoid (III) complexes

Okawa *et al* have shown that sterically controlled lanthanoid complexes, fac-^-tns (4-menthyloxy)-1-(*p*-tolyl)-butane-1,3-dionate) lanthanoid (III) behaves as a Lewis acid catalyst for enantioselective reduction of ketones like acetophenone, octan-2-one, butan-2-one, with $NaBH_4$ in cyclohexane. (*J.C.S. Chem. Commun.* 1989, p. 139-140).

Use of zeolites as catalysts for reaction of phosphines and silanes with olefins

Hoelderich *et al* have shown that zeolites and aluminium phosphate act as a catalyst for the reactions under reference. Zeolites are superior to aluminium phosphates. (Paper presented at Catalysis Congress, Calgary, Canada, 1988).

Oxidation of RSH to disulfides

Shell have claimed that higher mercaptans, e.g. $CH_3(CH_2)_{11}SH$ can be oxidised with O_2 in a two-phase system with xylene as a solvent and aqueous NaOH. A PTC like TEBAC and/or Cu salt is used. (EP 288,104, Oct. 1988, *CA* 1989, **110,** 94511).

Preparation of optically active 1-methyl-3-phenyl propylamine by amination of the corresponding sulphonates

Kanegafuchi of Japan have claimed that the reaction under reference is possible with NH_3 under a pressure of 46 kg/cm² to give 100% (R)-of 93% optical activity. (*Chem. Abstr.* 1989, **110,** 94667).

Asymmetric hydrocyanation of a range of aromatic and aliphatic aldehydes

Matthews, Jackson and co-workers have shown that most

aryl aldehydes with electron-donating substituents in the *m*- or *p*- positions, in the presence of the "INOUE" catalyst (R,R)- or (S,S) cyclo(phenylalanylhistidyl), give cyanohydrin with high ee (>80%). However, amylaldehyde with strong electron-withdrawing groups and alkyl aldehydes and ketones give low ee (<50% and <30% respectively). (*Aust. J. Chem.* 1988, **41**, 1697).

Nitroalkanes from bromoalkanes

Sane and Sharma have shown that 1-nitropropane, an intermediate for ethambutol, can be made in about 85% yield from 1-bromopropane with TBAHS as the phase transfer catalyst; 1-bromopropane, in turn, is made from the reaction of HBr with propylene with peroxide catalyst to give the anti-Markonikov reaction. (*OPPI* 1988, **20**, No. 6, 598).

The chemical effects of ultrasonics

Suslick, who has done some pioneering work in this field, has given a very useful account of this subject in a recent issue of *Scientific American* (1989, Feb. p. 80). Intense ultrasonic waves traveling through liquids generate small cavities that enlarge and implode, creating tremendous heat. Thus an unusual chemical environment is created. High volues of intensification factor have been realised particularly for solid-liquid reactions. Suslick and coworkers estimate that the heating and cooling rates during cavitation are more than a billion degrees C per second! Bulk of liquid remains at the ambient temperature. Industrial scale applications are expected in the near future.

Discovering new medicines

Ganellin (formerly of SKF and now at MIT, USA and who was associated with the SKF's antiulcer drug) has given a fascinating account, in his Messel Medal address of 1988, of nuances in discovering new medicines. No drug has a single action and it is necessary to use chemistry to manipulate molecules articulately; selectivity of action is all important. In the course of the last forty years important drugs like anti-histamines, sulphonamides, antimalarials (in 40s); corticosteroids, phenothiazines, thiazides (50s); oral contraceptives, semi-synthetic penicillins, benzodiazepine, ß-blockers, anti-hypertensives (60s); anti-tumour, immunosuppressants, H_2-antagonist anti-ulcer (70s), etc. have been introduced. Sources for new drugs can be existing drugs; natural products; animal model screens; hypotheses based on physiological mechanisms. For instance these new H_2-receptor histamine antagonists for treating peptic ulcers.

Modern 'rational approach' to drug design is based on understanding of physiology in relation to diseases and depends on new knowledge emanating from cell biochemistry and cell biology. In broad terms, there are five main sites for the action of drugs: enzymes; hormone receptors; transport systems; cell replication and protein synthesis -- DNA and RNA; storage sites.

R & D is of crucial importance but since very speculative today, the weakest link in drug development is the safety as it is extremely difficult to predict.

"The accountants in most industries would not permit their companies to commit themselves to such risks. The rewards of success are great, and the greatest of these is surely the relief of human suffering". (*Chem. Ind.* 1989, 2 Jan. No. 1, p. 9-15).

Getting more from agriculture

This exercise is repeated all over the world as "renewable" raw materials like starch, cellulose, oil, fats, sugar, etc., can be versatile feedstocks. Europe is again discussing this subject. Thus starch and modified starches can be used with polyethylene to get better barrier properties and biodegradability; thermoplastics containing upto 95% starch are possible. New developed starch hydrolysates with very high maltose content make available glucose at a controlled rate. Cyclodextrins are finding new applications including controlled release of drugs.

Chiral building blocks, eg. 1-erythrulose can be transformed into the drug *gamma* - amino - betahydroxybutyric acid, the vitamin biotin, etc. (another example is 1-(S)-glyceraldehyde).

Oxidized carbohydrates like gluconic and glucaric acids can replace phosphoric acid in derusting and in complexing metal ions. Reductive amination of d-glucose gives d-aminosorbitol. (*Mfg. Chem.* 1989, March, p. 41 and 43).

NEW PROCESSES

Diphenyl Carbonate (DPC)

A Chinese patent refers to the reactions between phenol and calcium hydroxide and subsequent reaction with phosgene to give DPC; the product mixture is acidified with HCl to give 99.6% crude DPC. (*Chem. Abstr.* 1989, **110**, 94695).

2,6-Difluorobenzamide (DFB)

Shell have claimed that 2,6 dichlorobenzoyl chloride can be converted to the corresponding fluoride with KF which when reacted, in MeCN medium, with NH_3 gas gives DFB. (EP. 281,186, Sep. 1988, *Chem. Abstr.* 1989, 110, 94699).

Glyoxylic acid (GA)

Chemie Linz have come out with a new process, which is pollution free, where dimethyl maleate is oxidised with ozone. (*Chem. Eng.* 1989, 96, No. 36, p. 21)

YLON 6,6-PROJECT

Thapars offer to raise export commitment

The Thapars have offered to the ovt. a substantial hike in export com-itment for the nylon-66 project pro-osed to be set up in collaboration with u Pont, it is understood. The earlier roposal for the setting up of the pro-ct in Goa had been rejected by the ovt. recently on grounds of "perpet-al import of raw materials for the plant, art import of second-hand technology nd no visible benefit in technology".

It is understood that the Thapars have rgued that the only visible drawback n the earlier proposal was that the xport commitment was not consistent vith the import requirements for the roject. For this, they are believed to ave asked the Government to indicate he extent to which it would like the xport commitment to be raised. epending on this, they are willing to egotiate with Du Pont.

They are also believed to have advanced the view that with the bring-ng in of nylon-66 technology, the exist-ng manufacturers of nylon-6 would not e jeopardised, as there would be sub-stantial room for the tyre industry to absorb both nylon-6 and nylon-66 in view of the severe raw material crunch eing faced by the industry. The Tha-pars are also believed to have cited the support of the tyre manufacturers to advance their fresh proposal.

However, it is not yet known if the Government is willing to reconsider the fresh proposal. But, indications are that the Government may give it a second look in view of the recent proposal and the Goa Government's eagerness to have the project in the State.

The Goa Chief Minister is on record saying that the State Government has decided to allow the nylon-66 plant at Keri, Ponda, in central Goa. The State Government has already allocated 123 acres of land for the project at Keri. The Chief Minister has expressed keenness on the project as it is expected to generate direct employment to 1,032 persons and indirect employment to 4,000 others. The Thapars' recent proposal sheds light on the fact that they have not given up hopes for bringing the Rs. 40,000-crore US giant, Du Pont to India. The nylon-66 project being contemplated by them envisages production of 14,000 tonnes against the present production capacity of 7,000 tonnes of nylon-6 in the country.

PASUPATI ACRYLON UNIT TO BE READY NEXT YEAR

A Rs. 100-crore acrylic fibre plant with a capacity of 12,000 tonnes will go on stream early next year at Thakurdawara in Moradabad district of Uttar Pradesh. Being set up by Pasupati Acrylon Ltd., the project has the technical knowhow of Snia BPD, the famous Fiat group of Italy, which is one of the world's largest manufacturers of acrylic fibre. This is likely to set right the domestic distortions in the demand and supply position of the fibre in 1990.

The project which is now in an advanced stage of implementation has already obtained a 'no objection certificate' from the UP State Pollution Board. Apart from the 6 MW load which has been sanctioned by the UP State Electricity Board, captive power generation facilities are also being installed to meet the full load requirement.

Presently there are two manufacturers of acrylic fibre in the country including the State-owned Indian Petrochemicals Corpn. Ltd. (IPCL) together accounting for an installed capacity of 36,000 tonnes per annum. Acrylic fibre is the major raw material covering as much as 25% of textile applications the world over. They include knit wears, woollen and worsted fabrics, blankets, carpets, etc.

PETROCHEM PROJECT

BPCL asked for fresh proposal

The Bharat Petroleum Corporation's (BPCL) ambitious plan to set up a petrochemical project close to its refinery in Bombay is back to square one after the proposal has moved about in the bureaucratic quagmire for over three years without any tangible results.

It was in January 1986 that BPCL had submitted a feasibility report to the Government about the project which was expected to be completed in 36 months from the date of approval. It could have helped the country save Rs. 100 crores by import substitution annually. Thirty nine months later, the Union Ministry of Petroleum and Natural Gas has again asked BPCL to submit a fresh proposal about the same project.

The revised proposal has been called for because the project which was estimated to cost Rs. 260.40 crores in January 1986 would naturally cost a lot more now because of the gap between now and when the proposal was first mooted. So, BPCL is busy going about the exercise once more after a lapse of four years.

The Ministry of Petroleum and Natural Gas could not take up an investment decision because the BPCL proposal got stuck with the Ministry of Environment and Forest. Going through the movement of the proposal, it appears that the latter was never in a hurry to settle the matter one way or the other in spite of proddings. It was in January this year that the proposal was finally cleared from the environment angle.

After the proposal was submitted by BPCL in January 1986, it was considered by the Public Investment Board (PIB) in July 1986. After deliberations, PIB decided that the project would not be considered till it was cleared from the environmental angle. The Ministry of Environment and Forest did not clear the project. In its letter dated March 6, 1987, it rejected the location of those three BPCL projects at Chembur. At the instance of the Ministry of Petroleum and Natural Gas, the Ministry of Environment, however, agreed to get the matter reviewed by an expert committee. Accordingly, the committee was constituted in June, 1987 and it was expected to submit the report by end-July, but the same was submitted much later.

Meanwhile, the committee of Secretaries considered the issue in October last year when it was decided among other things, that 'keeping in view the environmental objections which could arise against the location of the paraxylene plant at Chembur, the setting up of the plant at Nagothane should be considered and finalised urgently'. Subsequently, the Cabinet Secretariat and the Department of Environment were told that the shifting of the projects can have serious repercussions and they were, therefore, requested to consider the report of the expert committee and expedite the clearance of all the paraxylene, n-paraffin and propylene projects of BPCL.

Simultaneously, BPCL was also asked to prepare fresh cost estimates for the two projects -- paraxylene and n-paraffin -- for locating them at an alternative location like Nagothane, with reference to the existing as well as the new location and the latest price levels.

The Ministry of Environment and Forests, in its letter dated January 10, 1989, granted environmental clearance for the project of BPCL to optimise the production of aromatics, subject to certain conditions. Consequently, BPCL has been asked by the Petroleum and Natural Gas Ministry to send revised cost estimates of the project.

BPCL is operating a refinery at Bombay with a capacity to process six million tonnes per annum of Bombay High Crude. It has already the facilities for producing 98,000 tonnes per annum (TPA) of benzene and about 18,000 TPA of toluene from high aromatic naphtha available at the refinery. In view of the assured availability of Bombay High crude (BPCL is connected to Bombay High fields by a pipeline), it was felt that the BPCL refinery at Bombay could be the ideal location for optimising the production of petrochemical feedstocks from the Bombay High crude.

In order to optimise these facilities and also to improve the value addition of the crude mix, BPCL had proposed the creation of facilities for production of 100,800 TPA of paraxylene, 20,400 TPA of orthoxylene and extraction of 79,000 TPA of n-paraffin from naphtha and kero streams respectively, besides separation facilities for 51,180 TPA of C3 and C4.

COCHIN REFINERIES PLANS FURTHER EXPANSION

Cochin Refineries Ltd. (CRL) has drawn up an ambitious programme involving planned outlay of over Rs. 1,000 crores for further expansion and diversification into the petrochemicals field in the Eighth Plan period.

Addressing a news conference at Cochin on April 16, the Company Chairman and Managing Director, Mr. J. Jayaraman, said as part of the diversification into the petrochemicals area, a Rs. 75-crore aromatic recovery unit (benzene project) for the production of 87,200 tonnes of benzene, has been installed.

He said the project is expected to bring about a foreign exchange saving of about Rs. 59 crores a year by reducing imports from this year. He said another product proposed to be added to the CRL's multi-product state was toluene. The project for annual production of 12,000 tonnes of toluene was scheduled to be commissioned during August this year. He said 1988-89 had been an year of record achievements in throughput, profits, capacity utilisation and turnover. Mr. Jayaraman said during 1988-89, CRL had processed 4.761 million tonnes of crude, the highest throughput ever achieved against the design capacity of 4.5 million tonnes. This marked a capacity utilisation of 105.8%.

IJAIPUR POLYPROPYLENE PROJECT

GAIL to go it alone

The Union Government has shot own the proposal to set up the prestious Rs. 450-crore polypropylene proct at Bijaipur in Madhya Pradesh in e joint sector in collaboration with the 'am Organic group. It is now certain iat the Gas Authority of India Ltd. GAIL) will go it alone to implement iis project along with the Rs. 400-crore PG project already assigned to it.

According to reliable sources, a ormal decision to this effect was taken ecently by the Cabinet Committee on Economic Affairs, which had serious eservations about the involvement of 'am. Although only a part of the equity vas to be shared by Vam, the proposal nvisaged vesting in it the entire mangement control and marketing of polyropylene.

The rejection of Vam gives this "up nd coming" company a severe setback, s the polypropylene project was xpected to be its flagship venture leadng to its further progression, particuarly in the lucrative fields of petroleum nd petrochemicals.

The Government's decision is stated o be in tune with the latest official hinking to discourage entry of private ector companies in petrochemicals vithout adequate financial stake. In this egard, the Government is reported to iave accepted the recommendation of he report of the committee headed by Mr. J.J. Mehta, former Chairman of PCL, that private companies without dequate financial strength and mangement experience should not be llowed to jump on to the petrochemcals wagon just for a "status symbol". The report also lays down minimum apacities for petrochemical units.

Another factor which has weighed vith the Government in entrusting the ntire petrochemicals complex at Bijaiur to GAIL is the successful commisioning of the Rs. 1,700-crore HBJ Hazira-Bijaipur-Jagdishpur) gas pipeine project by GAIL -- although with ne help of the Franco-Japanese consortium -- without undue cost and time over-runs. The 1,700 km pipeline is now being extended right up to Delhi faster and cheaper without the help of the consortium.

It is felt that GAIL has not only acquired the requisite management expertise to handle the entire Bijaipur petrochemical complex, but that it should also be able to mobilise the funds required to put the project through. In fact, the whole project was originally proposed to be established in the public sector. But later, apprehending a resource constraint, the Government assigned the LPG project to GAIL and threw open the polypropylene project for private participation. The Bijaipur petrochemicals project envisages production of 4,05,000 tonnes of LPG in two streams, 1.80 lakh tonnes of propylene and 140,000 tonnes of polypropylene. GAIL hopes to commission the first stream of the LPG project with a production of 203,000 tonnes by mid-1990 and the second stream of equal capacity in 1991.

A part of the propane production will be blended with LPG and the rest will be dehydrogenated to yield propylene, which will then be polymerised into polypropylene -- a versatile thermoplastic material used for packaging, injection moulding and several other end-uses.

DUTY RELIEF FOR RAW MATERIALS

The government has exempted, till September 30, 1989, raw materials and components required for the manufacture of goods to be supplied to World Bank, International Development Association as well as bilateral and multilateral aided projects or the replenishment of raw materials and components used in these goods, from the customs duty and additional duty. The exemption will be subject to conditions mentioned in Appendix 13-b of the import-export policy (Volume-I).

JK bags Saleempur aromatic project

The JK group of the Singhanias has bagged the Saleempur aromatic complex project. The Cabinet Committee on Economic Affairs has cleared the proposal on the basis of the Abid Hussain committee recommendations to which the matter had been referred.

The project approval board (PAB) had cleared the JK proposal in October 1988 itself. However, the entry of the Thapars into the race at a later stage had created doubts as to JK house's getting the project. The Thapars had claimed that their bid did not involve any foreign exchange outgo as they had tied up with the Soviet Union and payments were to be made in rupees. The Ministry, contrary to these reports, however, had not received any formal application from the Thapars, it is learnt.

Earlier, the JKs had scored over Reliance Industries and the Birlas when the project was thrown open to the private sector after abandoning the idea to have it in the joint sector.

Originally, the joint sector approach had been favoured as the project involved huge outlay and the public sector, Indian Petrochemicals Corporation Ltd. (IPCL), was already over-burdened. A letter of intent was issued to the Pradeshiya Industrial and Investment Corporation of Uttar Pradesh (PICUP) in March 1986. It lapsed after a year as PICUP failed to find a private partner.

The project to be located at Saleempur in Aligarh district of Uttar Pradesh is estimated to cost Rs. 850 crores and the foreign exchange outgo will be Rs. 240 crores. The company proposes to raise the amount from internal accruals and loans from foreign banks. Foreign exchange will be required for knowhow, licence fee and purchase of equipment and catalysts etc. The delay in clearing the project as also the procedural delays might result in huge cost escalations. The company now has to obtain a letter of intent. The implementation of the project may take 30 to 36 months.

The company's proposal envisages manufacture of 150,000 tonnes per annum of purified terephthalic acid (PTA). The corresponding figure of paraxylene (p-xylene) the basic raw material for the manufacture of PTA, is 105,000 tonnes per annum. The company also proposes to produce 30,000 tonnes of benzene per annum for the manufacture of downstream products like styrene, LAB, maleic anhydride etc. Manufacture of 30,000 tonnes per annum of orthoxylene is also proposed.

The JK group itself has the capacity to absorb 60 to 70 per cent of PTA produced in units like JK Synthetics, Orissa Synthetics, Raymonds etc.

GAIL PLAN TO LINK ONGC, OIL FIELDS IN ASSAM

Gas Authority of India Ltd. (GAIL) has prepared a Rs. 400-crore plan that seeks to link the Oil and Natural Gas Commission (ONGC) and Oil India Ltd. (OIL) gas fields in Assam and pool the surplus gas from this grid for transportation up to Jorhat.

The total gas proposed to be transported through this trunk pipeline would be around 3.5 mcmd. Out of this 2 mcmd of gas would be consumed by the proposed power plant of Assam State Electricity Board (ASEB) and the balance would be given to other consumers in and around Jorhat.

The project would help in utilisation of gas from associated fields which is flared on account of consumers not utilising OIL's free gas reserves and the establishment of the power project near Jorhat. According to official sources, the project has three components: (A) construction of the pipeline; (B) setting up of the power plant and; (C) development of OIL's free gas fields.

The Assam Government had earli suggested that the Assam Gas Compa be allowed to construct the trunk pip line up to Jorhat either on its own or a joint venture.

However, following discussions wi the Union Government, the Assa Government has agreed to allow GA to take up this project. The State Go ernment was told that Assam Gas Co pany could be associated with t project of taking up the spurlines f transporting gas to the other consum ers and its marketing. According informed sources, the Assam Gover ment has since accepted the proposa

The Assam Government is also sep arately taking action for preparing a fea sibility report for the proposed powe plant near Jorhat. Steps are also bein simultaneously taken to get a detaile feasibility report prepared for the devel opment of OIL's free gas reserves.

LONG-TERM PLAN URGED TO DEVELOP HAZIRA COMPLEX

The Gujarat Chamber of Commerc and Industry has advocated drawing u a comprehensive and long-term maste plan for integrated development o Hazira complex which is estimated t involve massive investments of th order of Rs. 8,000 crores to Rs. 10,00 crores in petrochemicals, gas processing and allied industries in the next few years. The chamber has also underlined the need to take advance action for provision of requisite infrastructural facilities there to hasten industrial development. While appreciating the initiative taken by the State Government for accelerating the development of Hazira port, Mr. Dilip Parikh, president of the chamber, pointed out that still larger financial allocations should be made so that Hazira could be used as a chemical container terminal for import and export of chemicals and it can also serve as an alternative to Bombay port which is heavily congested all through the year.

Plastic sack exports to touch Rs. 100 crores

Two years after the jute packaging aterials order expelled it from its ajor markets at home, the plastic oven sack industry has made a pain-l entry into the export market. Exports uring 1988-89 are expected to exceed he Rs. 100-crore mark. The industry ad exported sacks worth Rs. 64 crores during the previous year.

The Plastics and Linoleums Export Promotion Council (PLEXCONCIL) has projected a target of Rs. 170 crores in 1989-90. A four-member PLEX-CONCIL team is now touring Europe and the USSR to locate new end users and to wean away customers from China, who dominate the plastic sacks and fabric market.

The above figures convey the impression that the sick industry has turned the corner by following the Government's prescription to venture overseas. Nothing could be further from the truth, according to industry sources at Bombay. If anything, exports are prolonging the slow strangulation of the industry, it is claimed. The record export turnover comes from less than 10 units of an estimated 500-odd units. More than 200 units have been closed for more than a year. Except for some 40 units, the rest of the surviving units run sporadically to execute occasional orders.

"Exports enable us to keep our units running. It does not generate profits to repay our loans" explained a prominent exporter. Export price is around Rs. 3 to Rs. 4 per bag, which allows for little margin. The industry's poor opinion of its health is corroborated by financial institutions, who are working on relief packages allowing relaxation in repayment terms.

Only a handful of large units have succeeded in penetrating the export market in their struggle for survival. Small units find it almost impossible to gain the confidence of overseas buyers when a single order is equal to a small units annual installed capacity. The only way out is to form a consortium to execute overseas orders. The idea has not been working well due to obvious reasons. Chinese units, in contrast, have massive installed capacities which makes for speedier execution of orders in addition to achieving economies of scale.

Small units wanting to export have to face many technical problems. For one thing, the overseas market is almost exclusively in polypropylene bags. Indian looms with their old tape machines can process only high density polyethylene. Besides, export market is unlikely to grow beyond 10,000 tonnes in the coming years and, as such cannot compensate for the 40,000 tonnes of capacity snatched away by the jute order, industry sources said.

PLEXCONCIL TEAM TO EXPLORE OVERSEAS MARKETS

The Plastics and Linoleums Export Promotion Council (PLEXCONCIL), in its pursuit of an ambitious export target of Rs. 170 crores for the new financial year has deputed a four-member delegation for a three-week tour of France, Spain, Netherlands, East Germany, Romania and USSR to explore the export potential for Indian plastic woven sacks.

This was stated at Bombay recently by Mr. D.L. Logasundaram, member-secretary of the PLEXCONCIL, who is leading the delegation. He said the team wouuld locate end-users and introduce plastic woven sacks and fabrics in these markets to put up a competition against Chinese counterparts.

CORRIGENDUM

In the article under spotlight on inorganic chemicals, 'Single Superphosphate' appearing in CHEMICAL WEEKLY dated 11th April 1989, the following errors have crept in inadvertantly in the flowsheet. 1. Water is shown leaving the scrubber instead of entering it. 2. The exhaust fan is marked as I.O Fan whereas it must be I.D. Fan.

Chavan's assurance to plastic processors

The Finance Minister, Mr. S.B. Chavan, agreed to have a second look at the Central excise notification No. 38/89 clamping a 15 per cent ad valorem levy on plastic articles.

Mr. Chavan gave this assurance to a delegation of the plastic processing industry which called on him at Bombay. The delegation explained that the notification would hit thousands of units which could not avail themselves of the Modvat benefit. The industry is already subjected to a high incidence of excise and customs duty which makes plastic raw materials in India the costliest in the world, the Minister was told.

It is reliably learnt that the Government move was directed at some leading manufacturers of thermoware. The removal of excise exemption enjoyed by all producers of plasticware, however, has hit thousands of small and tiny units whose products like plastic cups and saucers are sold on city footpaths and at village festivals.

The officials who had conceived the notification seem to have mistaken newness for luxury, according to an industry spokesman. Plastic cups and saucers are new products. But they are not luxury items as they are used by the poor and the middle class. Similar articles made of glass, china and stainless steel still enjoy excise exemption on the ground that they are used by the common man.

Vacuum flasks made of glass enjoy exemption on the ground that they are energy saving and are used by the common man. Polyurethane insulated plastic articles are more versatile, less fragile than glass and serve the cause of energy conservation better. Similarly, stainless steel casseroles, water jugs, tiffin carriers and lunch boxes are exempt from levy. Plastic cups, saucers etc, are progressively being used by the Indian Railways because of cost effectiveness, hygiene and convenience.

In order to pay excise, small and tiny units who constitute 90 per cent of the industry, will have to incur about Rs. 1,000 every month in staffing and other expenses, according to industry sources. There are some 5000 moulders in the small sector. In return for a Rs. 6-crore burden on the industry, the Government hopes to earn only Rs. 1 crore as revenue.

About half the raw materials consumed by the industry is imported. The small units do not get supplies from indigenous polymer producers and have to depend on trade for small quantities. They are unable to produce excise gate passes for such small transactions and consequently cannot claim Modvat. sizeable quantity of these plastic ite are made from recycled plastics.

PIB CLEARS IPCL PROJECTS

The Public Investment Board (PI has given first stage investment clea ance for three projects of the Indian Pe rochemicals Corporation Ltd. (IPCL The projects worth Rs. 600 crores rela to wire and cable compounds, advance engineering plastics and modernisatio and expansion of the polybutadien rubber (PBR) unit.

According to official sources, th modernisation and expansion of the PBR project involves an investment of Rs. 104 crores in which the foreign exchange component is Rs. 30 crores. IPCL proposes to expand the existing capacity from 20,000 tonnes per annum to 50,060 tpa. The demand gap for PBR in the country during 1989-90 is placed at 345,000 tpa. By 1999-2000 it is expected to come down to 132,000 tpa. The PIB has now given first stage clearance for incurring an expenditure of Rs. 17.50 crores on the project with a foreign exchange component of Rs. 11.50 crores. The Rs. 560-crore plastics project will be executed in two stages, phase one costing Rs. 79 crores of which Rs. 30 crores would be in foreign exchange.

Polymer price hike decried

The plastic processing industry most which is in the small scale sector ceived another blow with one more ice increase announced by IPCL and olyolefins Industries Ltd. increasing eir ex-factory price by Rs. 1,000 to s. 1,500 per ton on LDPE, PVC, PP nd HDPE. According to Mr. Anil B. oradia, President AIPMA, both these olymer units admittedly know that ndian plastic processing industry has ad one of the worst years in 88/89, due o sky high polymer costs with small nits operating below 30% to 40% apacity. These manufacturers, accordng to him are taking advantage of the teep import duties of 104% to 246% mposed by the Government of India on lastic raw materials and take every pportunity to revise their prices.

"In the long run this is going to be most ill conceived, as with sickness of rocessing sector and higher costs to rocessors the common man is comelled to pay more for plastic articles, ackaging etc. and the country's probem of high cost economy bogs down rogress", Mr. Goradia added.

Mr. Goradia felt that the price increases run contrary to the statement of the Prime Minister in Parliament, noting that plastic prices in the country were very high and should be brought down. However prices today are "60% higher and no one at the centre has taken any initiative to stop this trend. The scene now is that petrochem units have reported high profits this year, while processors have reported their worst financial performance".

"The last secretary, Mr. H.K. Khan (Dept. of Petrochemicals) had categorically assured the plastic industry in August 1988 that no price increase would be allowed by petrochem units -- howver, it seems the Secretary's directives are not being heeded to, the PM's appeal is not being respected in spirit and the thousands of small scale processors are helpless on-lookers suffering in silence while Indian petrochem units keep raising prices in their bid to show larger profits for their corporations -- unmindful of the users in this country."

DGTD CALLS MEET ON CAPROLACTUM

DGTD under the Union industry ministry has called a meeting of the caprolactum producers and consumers in the country at New Delhi on April 25, 1989 to assess its import requirement during 1989-90. Caprolactum is a basic raw material for the production of nylon filament yarn and nylon tyre cord. The Gujarat State Fertilisers Corporation (GSFC) is the lone caprolactum producer in the country, meeting around 20 per cent of the consuming industry's requirement.

The meeting will review the supply and demand position which is expected to undergo a vast change in view of the expectation of Fertiliser and Chemicals Travancore Limited (FACT) going on stream during the current year. While at the same time the industry's requirement is increasing in view of the sharp increase in demand for NFY and NTC.

GSFC having an installed capacity of 20,000 tonnes of caprolactum per annum produces around 18,000-19,000 tonnes, out of which supplies to nylon industry averages at 14,500-15,000 tonnes. Now, with Gujarat Nylon commencing production, part of the supply is also expected to be diverted to that unit. FACT with an installed capacity of 50,000 tonnes per annum, may help augmenting the tight supply position of this basic raw material for nylon industry, if it comes on stream towards the last quarter of 1989. Nylon yarn production, which had declined from 39,525 tonnes in 1985-86 to 33,929 tonnes in 1987-88, is estimated to have improved to around 37,000 tonnes during 1988-89.

RCF to assist in Haldia rehabilitation

The immediate prospect of Rashtriya Chemicals and Fertilisers Ltd. (RCF) taking over the Haldia fertiliser plant of the Hindustan Fertiliser Corpor tion (HFC) being ruled out, RCF has agreed to take care of the project as a project management assignment and help commission, produce commercially and stabilise. All that it wants for this rehabilitation responsibility is cost of equipment, services and staff that will be needed for the Haldia project.

Disclosing this, Mr. R. Venkatesan, Chairman and Managing Director of RCF, said that RCF is financially well off to take care of the financial requirement of the Haldia rehabilitation. "We made our stand to the Government very clear. We are prepared to take over the Haldia project only as a project management assignment".

On this assumption, RCF has submitted a further report indicating the priority of areas if the Government decides to assign the job to RCF. Methanol production is an important area, but for this the ammonia plant will have to be run. The first phase is likely to take about three years, according to Mr. Venkatesan.

Asked why RCF is not taking over the plant, he remarked that without measuring the depth how one could jump into the issue.

The study has indicated a lot of technical shortcomings. However, the plant could be rehabilitated. RCF senior executives have talked to the Haldia personnel and were assured of cooperation, Mr. Venkatesan added.

GSFC TURNOVER AT NEW PEAK

The joint sector Gujarat State Fertilisers Company (GSFC) at Baroda achieved a peak turnover of Rs. 640 crores in 1988-89, an official spokesman said on April 18. Reviewi GSFC's performance over the year, company spokesman said that both pr duction and sales had registered impr sive increases during the year 1988-8 while fertilisers and caprolactum pr duction registered 32 per cent and per cent increases respectively, 1988-89 as compared to 1987-8 Nylon-6 and argon production al increased by 21 and 12 per cent, respe tively, he said.

Similarly, the product-wise sal increases over the previous year wer 36 per cent for fertilisers, 27 per cen for Nylon-6, 18 per cent for argon an 36 per cent for caprolactum, he said The spokesman said that the first phas of the company's co-generation o steam and power project had gone on stream and work on the second phas had already commenced.

The entire project which would cost around Rs. 72 crores would produce 40 MW of power, he said.

Fertiliser output to exceed target

The fertiliser industry is poised to achieve a production level of 8.72 million tonnes in 1988-89 against the targets of 8.6 million tonnes. The production will comprise 6.45 million tonnes of nitrogenous fertilisers and 2.27 million tonnes of phosphate, says the annual report of the Department of Fertilisers.

The report says the growth in production is 68 per cent over a period of five years. With the increase in the production of indigenous fertilisers, the gap between demand and supply has considerably come down, and consequently the import of fertilisers has drifted from 3.62 million tonnes in 1984-85 to 984,000 tonnes in 1987-88.

This was despite a spurt in the consumption of chemical fertiliser from 5.5 million tonnes in the early 1980s to 9 million tonnes in 1987-88 and an estimated 11.33 million tonnes in 1988-89. The report says the overall capacity utilisation of fertiliser units during 1988-89 is expected to be more than 80 per cent. In the case of nitrogenous plants the capacity utilisation has gone up to 79.2 per cent from 77.2 per cent in the previous year, and for phosphates it has increased to 85.6 per cent from 71.5 per cent in 1987-88.

Ten fertiliser projects are at present under implementation. These include six nitrogenous and four phosphatic plants. Because of the continuous expansion of the industry, India today ranks fourth in the world production and consumption of nitrogenous fertilisers and occupies the sixth position in production and consumption of phosphates.

The country has now the capability for planning, designing, constructing and commissioning new large sized plants on its own, with more than 70 per cent of equipment from indigenous sources. The fertiliser retention price scheme and the freight subsidy scheme continue to be in force and the subsidies dispersed under these scheme have increased from Rs. 1,600 crores in 1985-86 to Rs. 3,000 crores in 1988-89. The Budget provision for 1989-90 is Rs. 3,121 crores. The performance of various public sector fertiliser units shows the two sick companies incurring losses since their inception are the Fertiliser Corporation of India (FCI) and the Hindustan Fertiliser Corporation (HFC). The losses are attributed mainly to design and equipment deficiencies.

AP OFFICIALS WORRIED OVER DAP SUPPLY

Will the distribution of DAP (diammonium phosphate) fertilisers be timely and through proper agencies this kharif season?

This question is worrying Andhra Pradesh farm officials at Hyderabad. In the absence of availability of domestic DAP due to closure of all the manufacturing units since January this year, the decision of the Union Government to import 25 lakh tonnes of DAP has lent certain optimism to farm officials.

It is, however, stated that in the five important kharif States -- Andhra Pradesh, Maharashtra, Gujarat, Karnataka and Madhya Pradesh the stocks of DAP are almost nil while their requirement is substantial. Growers of paddy, groundnut, sugarcane and pulses in these States are dependent on DAP.

A unique feature in most kharif fertiliser markets is that farmers use the fertilisers much before sowing operations commence. Hence the product required is to be moved to all parts in the region including those inaccessible during monsoon.

In some farflung areas in AP, like Adilabad, situated in semihilly and forest terrain, Diviseema in the coastal belt, the roads are not motorable once rains start. Farm officials, therefore, want the imported DAP made available to the vast dealer network of retailers as well as co-operatives by the middle or end of May.

The situation in Andhra Pradesh is stated to be all the more alarming as the only joint sector unit Godavari Fertilisers and Chemicals Ltd. (GFCL) has stopped production since middle of February owing to stoppage of imports of phosphoric acid.

It is also pointed out that during the monsoon, ships carrying the imported DAP cannot unload at the western sea ports. AP has been using Kakinada and Machilipatnam ports for handling these imports. GFCL, for instance, handled 2.2 lakh tonnes of imports during 1986-87 successfully before it went on stream the following year.

The Centre should ensure not only timely arrival of ships on the east coast for unloading operations and speedy distribution but also ensure distribution through agencies already familiar and popular in the region.

Since GFCL is jointly owned by IFFCO and the State Government, it should be given the opportunity to utilise its allocation of 1.10 lakh tonnes of DAP during the kharif season. When contacted GFCL officials, however, pointed out that their company will any way be used as the handling and distribution channel for AP as well as Madhya Pradesh in view of its excellent past record.

GFCL will only be too happy to involve itself at any terms fixed by the Centre as its DAP enjoyed 55 per cent of total market share in the State. State Government officials stated that the Centre is understood to have already placed orders for supply of 12 lakh tonnes of DAP from the world market but they continue to look forward to an official confirmation and assurance. An announcement will dispel misgivings on these issues, they added.

RCF bids for $ 400 m project in Iraq

Rashtriya Chemicals and Fertilisers Ltd. (RCF) has made a bid for a prestigious project that envisages expansion of an existing fertiliser complex at Al Aim in Iraq at an estimated cost of $400 million with buy-back arrangements.

The bid includes creation of additional capacities (per annum) of 0.643 million tonnes of phosphoric acid, 0.54 million tonnes of TSP and 0.52 million tonnes of DAP/NAP. It also covers setting up of facilities for 0.37 million tonnes of NPK and plants with a daily capacity of 2 x 1,000 tonnes for ammonia and 1,750 tonnes for urea.

According to Mr. R. Venkatesan, RCF Chairman and Managing Director, the company has submitted a technical bid. The commercial part of it is still to be made because it involved issues such as buy-back arrangements and advancing of credit facilities. The feedstock materials -- rock phosphate, sulphur and natural gas -- are available in the vicinity of the site at Al Aim. India can supply services and equipment worth more than half of the total project cost. Some critical equipment technology will have to be purchased from the international market for which credit is needed.

Iraq is keen on finalising the deal with India in view of the assured market here for the products. The buy-back arrangement will be beneficial to India in terms of price and reliability. Moreover, Indian engineers will gain by way of expertise which can be used to push up services export from the country.

The RCF team has already visited Iraq in this connection and held discussions with the authorities there. RCF has indicated that as a part of the buy-back arrangement, it will lift 2-3 lakh tonnes of phosphoric acid and 3-5 lakh tonnes of DAP in a year. The period of buy-back would be around 10 years. RCF has made the bid as part of its strategy to diversify operations in view of the dwindling returns in the production and sale of fertilisers. RCF has already made a bid for a Rs. 1,000-crore project in Sharjah for setting up ammonia and urea plants. The issue is still to be decided.

FRP PIPES IN NUCLEAR APPLICATIONS

In a project sponsored by the Department of Atomic Energy at IIT, Madras, the FRP research centre carried out a study to find out the suitability of fibre reinforced plastic pipes for use in nuclear radiation environments. Filament wound FRP pipes have good strength and corrosion resistance. If they do not have much degradation in mechanical properties under nuclear irradiation, they can find applications in the nuclear field.

It was concluded from the study that epoxy glass tubes are better than polyester-glass tubes for nuclear irradiation environment (75-80% gamma rays +20-25% neutron flux).

ONGC draws Rs. 800-cr R & D plan

The Oil and Natural Gas Commission (ONGC) has drawn up a Rs. 800-crore comprehensive research and development programme for the Eighth Plan.

Multiple completion technologies, enhanced oil recovery (EOR) schemes, drilling in shallow as well as deep waters, high pressure/high temperature drilling, geo-scientific surveys in category III and IV basins, exploitation of thin oil rim are the frontier areas of technology that will be covered in the next plan under this ambitious programme.

While formulating the programme care has been taken for developing a suitable technological plan of not merely acquiring modern equipment and knowhow but also identifying new options and suitably altering existing designs to cut down costs. Around 3300 R and D projects will be taken up, primarily by ONGC's seven R and D institutes in close association with regional laboratories and work centres including the ONGC computer centre. Promotion of research and development activities in the Commission has been identified as a key result area. The existing seven R and D institutes have been developed in a phased manner to cater to the various aspects of the whole gamut of oil exploration/production activities.

The integrated research activities provided by the in-house R and D of ONGC has been so planned as to reduce dependence on foreign knowhow with its distinct impact on indigenous technological build-up and reduction in costs.

It has been decided that ONGC would concentrate its activities largely on adaptive R and D. Basic research would be farmed out to universities and technical institutions through sponsored projects/joint research programmes. About 80 per cent of the projects handled by the institutes are sponsored by the operating regions and the rest are related to basic research.

The institutes which have emerged centres of excellence have been inno atively organised on the concept developing themselves as profit cent instead of the traditional set-up of R a D centres being marked as cost centr with the result that these institutes ha now become self-sustaining.

Recently, within the R and D ins tutes as well as the various busine groups, a concept of technological ce has been introduced. These cells are function as nodal agencies for techn logy forecasting through continuo environment scanning and technolo upgradation through applied researc

These cells are expected to serve nerve centres for technological exce lence and co-ordinating agenci between the research work and field-wise applicability as also to ma imise the collaborative effort with un versities and other technical institution

ONGC's R and D activity has helpe in significantly upgrading the techno ogies, besides providing back-up serv ces to operations in the field. R and activities carried out by the institute have helped in saving Rs. 63 crore during 1986-88.

The Keshava Deva Malaviya Institu of Petroleum Exploration at Dehra Du is credited with the successful perform ance in consultancy and contract wor for Abu Dhabi National Oil Compan besides providing services for a host c countries including Seychelles, Vietnar and Tanzania.

ONGC has also entered into a con tract with a Canadian firm for transfe of technology on photoinclinometer fo which manufacturing and marketin rights have been given to them. Th Institute of Reservoir Studies, Ahmed abad, develops schemes related to art ificial lift, well stimulation, etc Important contributions by the institut include exploitation of thin oil rir reservoirs and software for translatin maps into 3-D pictures. The institute ha acquired a reputation to be able to pro vide consultancy to various agencie like Oil India Ltd. and oil companies i Malaysia, Libya and Burma.

XPORTERS OF REPUTE

Licences to be cleared speedily

The commerce ministry has decided o expeditiously clear applications for icences of manufacturers and export- rs of repute, having a clean record luring the last few years.

This, however, does not mean that other cases will be delayed. In such cases, the Chief Controller of Imports and Exports (CCI and E) will process the applications thoroughly, according to official sources. According to a decision taken by CCI and E, to be notified soon, exporters will be allowed to file applications for REP licences every month instead of quarter. So will be the case with export and trading houses applying for the grant of additional licences.

Another important decision taken by the ministry pertains to the installation of fax machines in eight offices of the joint CCI and Es and another eight offices of deputy CCI and Es located in different parts of the country. As a result, there would be better coordination between the New Delhi office of CCI and E and other offices in regard to data and other information.

The new CCI and E, Mr. Tajendra Khanna, was visiting different centers to know the problems of exporters and importers. He met representatives of the Confederation of Engineering Industry (CEI) on April 21 and those of the northern regional office of the Federation of Indian Export Organisations (FIEO) on April 25.

Mr. Khanna told the Economic Times recently that his office will leave no stone unturned to help the exporting community as well as the manufacturers. Meanwhile, nationalised banks are understood to be working out the modalities of the scheme under whioh exporters will get the cash compensatory support (CCS) and duty drawback directly from them.

But exporters will have the option to get CCS either from the banks or the regional offices of CCI and E. Disposal of cases are being simplified as the commerce ministry has realised that exporters' valuable time should not be lost in chasing their cases without various government offices. Meanwhile, the Exporters Association, Ambala, has expressed concern over the withdrawal of CCS on scientific and optical instruments as well as electronic instruments and their spares. In a press release, the association has urged the Union government to restore CCS of 10 per cent without delay if the scientific instruments industry is to be saved from a total collapse.

CSIR PROPOSES MISSION FOR NICKEL EXTRACTION

The Council of Scientific and Industrial Research (CSIR) has recommended to the planning commission the establishment of a national mission on extraction of nickel, the strategic mineral for which the country is at present fully dependent on imports, Dr. R.K. Iyengar, additional director-general of CSIR, disclosed at Bhubaneswar recently.

Addressing the silver jubilee foundation day function of the Regional Research Laboratory, Bhubaneswar, Dr. R.K. Iyengar said that ony multilaboratory, mega-projects would be able to produce "tangible, earth-shattering innovation".

Dr. Iyengar said Council of Scientific and Industrial Research had launched a mission to deal with the problem of brackish water and it was likely to involve the petrochemical industry in designing liquid membranes for the purpose. It would also lay stress on coal gasification for power production from gas turbines which were found to be more efficient than steam turbines.

Industry favours joining Paris convention

The Indian Industry has finally come out with its stand on the patent laws. It desires that India should sign the Paris convention.

The urgency with which the views have come is to be seen in the light of India's decision to discuss intellectual property rights in the GATT round of talks. If patents were to come within the purview of GATT, it is believed that Indian interests would be jeopardised beyond redemption. This sudden stand has come almost three years after the Government first asked industry to make its recommendations.

The Associated Chambers of Commerce and Industry of India (ASSOCHAM) has taken the stand that India should straightaway join the Paris convention on patents with adequate safeguards to protect the country's national interest consistent with the international regime.

Meanwhile, deliberations were believed to be on at the FICCI secretariat to hammer out the industry's stand on patents and the Paris convention. Representatives of both ASSOCHAM and FICCI were believed to be taking part in the deliberations. It is now understood that the industry is bent on avoiding the patents and intellectual property issue being included in the ambit of the GATT talks. Industry sources confirm that India's present stand on patents is satisfactory and well-defined and the Government may not needlessly succumb to the US pressure.

The industry's stand on patents is believed to have also been influenced by the World Intellectual Property Organisation (WIPO) assurancce that India may join the Paris convention with its existing patent laws. It had already deliberated for three days on the issue with WIPO late last year.

According to ASSOCHAM, joining the Paris convention would not only be in India's longterm interests and in keeping with "our commitment to international economic order, but would also facilitate flow of foreign investment and technology transfer and boost the country's exports.

The chamber has already sent a communique to the Industry Ministry on the subject. It has pointed out that in view of the growing technological capabilities and research and development, it would be advantageous to have a patent regime to protect property rights of the innovators both at home and abroad.

The chamber has endorsed the Commerce Minister's views that Indian patent laws provide adequate protecti The reward for innovation must balanced by consideration of pub interest and development nee ASSOCHAM feels it should be v.th the powers of the Union Government stipulate such safeguards as may necessary to protect specific sector interests.

It may be recalled that ASSOC HAM's views in favour of India join ing the Paris convention were first aire in 1986, when the chamber was largel a multinationals' lobby.

However, with a significant influx o domestic industry interests in the las two years, the chamber had withdraw its earlier stand.

The communique suggests that th industry is willing to tow the softe WIPO line than the harder GATT option. The chamber has stated tha there is need for standardising the life of patents in India in respect of all sub stances to 14 years. This would be in line with the developments abroad.

ASSOCHAM has furuher said that India is now emerging as a producer of software. Considerable work is being done in such sunrise areas as biotechnology, genetic engineering and others. India is also talking about the plant breeders' rights.

TIFR scientists duplicate 'cold fusion' results

Scientists of the Chemical Physics Section of the Tata Institute of Fundamental Reasearch (TIFR), Bombay, led by Dr. K.S.V. Santhanam, have claimed to have duplicated the "fusion in a test tube" experiment of the two chemists -- Dr. Martin Fleischmann of the University of Southampton and Dr. Stanley Pons of the University of Utah -- reported some three week ago.

Similar results have also been reported from several other places, notably from the Bingham Young University, Texas A & M University and the Moscow University. A similar, but larger, experiment is also being planned at the Bhabha Atomic Research Centre (BARC), according to its Director Dr. P.K. Iyengar.

These experiments, if true, demonstrate the possibility of sustaining nuclear fusion -- fusing of light nuclei to form heavier nuclei along with release of energy -- even at room temperature. Nuclear fusion is the mechanism by which energy generation takes place in stars like the Sun. But temperature on the Sun is of the order of millions of degrees celsius and in thermonuclear or hydrogen bombs too such temperatures are created by a fission trigger to set off fusion reactions releasing enormous quantities of energy.

To fuse nuclei the repulsive electrical force between the nuclei has to be overcome. This is what is achieved by producing conditions of very high temperatures and pressures whereby the fusing nuclei attain sufficient energy to overcome repulsion. Electrostatic repulsion will be the least for the lightest nuclei. The lightest element is hydrogen followed by its isotopes deuterium and tritium. It is for this reason that attempts at fusion are centred around these nuclei. In these experiments electric current is passed in an electrolyte containing heavy water by placing two electrodes made of palladium, and the heavy water contains only deuterium. Fusion of the deuterium nuclei results in about 4.5 to 5.0 times less energy than that obtained from fusion of deuterium and tritium.

Tokomak reactors

Confining these nuclei in a small space packed with a very high density material so that the nuclei can come together by overcoming the electrostatic repulsive barrier is the key to achieving controlled fusion. Development of fusion research had, in the last four decades, led to concepts where high temperature plasma of the fusing nuclei are confined in a region by applying intense magnetic fields. These are the so-called "inertial confinement fusion" or tokomak reactors. That this fusion would be possible in a simple tabletop electrochemical experiment run by a car battery at room temperature -- and hence cold fusion -- had never even been thought of by scientists.

Palladium is a good absorber of hydrogen and deuterium. In the electrolysis experiment passing electric current releases deuterium ions from the heavy water and these get absorbed in the palladium metal electrodes. Though the exact mechanism by which the large amount of energy released in this experiment is far from clear it is believed to be due to nuclear fusion because some of the researchers have reported to have observed release of neutrons and helium along with the release of energy -- a must for fusion.

It appears that the density of absorbed deuterium was so high -- the palladium metal used was very thin -- that it could confine the deuterium nuclei long enough for their fusion. On the other hand, the flux of neutrons released is far below -- million times less -- what one would expect if all the energy came from fusion.

Unknown 'reaction'

Some scientists claim that this could be due to some unknown chemical reaction, but Dr. Santhanam says that no chemical reaction is conceivable in the reaction environment of the experiment that can release such quantities of heat. While the U.S. experiments used a solution of various salts in the heavy water, in particular titanium halides, the Indian experiment claims similar results using the very simple solution of sodium chloride in heavy water.

"Our experiment was not a mere repetition", Dr. Santhanam says. In Dr. Santhanam's set up current was passed for a minute which liberated large quantities of heat. "We are not calling it fusion though this appears to be a possibility".

"What we are talking of is a very small effect that nobody bothered to look for", says Dr. Iyengar. It is not fusion in the strictest sense, according to him. He said that this was somewhat akin to the muon-mediated nuclear fusion where deuterium atoms have their electrons replaced by muons and this reduces them in size. This in turn, increases the probability of the nuclei coming together.

"The same mechanism perhaps occurs in palladium with titanium atoms in the interstitials of its lattice. If the so-called d-electrons are bound to deuterium nuclei, it is possible for these electrons to behave as if they were five times heavier. This would make the deuterium atomic sizes proportionately smaller. This would then enhance the fusion probability", Dr. Iyengar said. "By the month end we will know what it really happening from our experiment."

Moscow achieves similar results

A nuclear fusion reaction has been achieved at room temperature in the laboratory of solid physics of Moscow University, by Professor Runar Kuzmin.

By applying an electric current measuring upto 0.00003 ampere, the researchers observed water heating to the boiling point and the release of fast neutrons.

"We have registered the release of neutrons which was three to five times larger than the 'background'. The release of neutrons gives ground to say with certainty that it is the reaction of nuclear fusion", Professor Kuzmin said.

SPOTLIGHT ON
Biotechnology & Life Sciences (Part 2)

IMMOBILIZED ENZYMES HARNESSED TO BIODEGRADE PHENOL AND FORMALDEHYDE

Immobilized enzymes can biodegrade phenol and formaldehyde in waste streams reported Hubert Attaway, a Manville (Denver, Colorado) research microbiologist at Biotech (USA) '88 held in San Francisco last November.

In laboratory tests, Attaway immobilized a bacterial culture -- the organisms were tentatively identified as *Psudomaona SP* -- on 100 gm of a porous silica-based biocatalyst carrier suspended in a one-litre continuous flow fluidized-bed reactor. The phenol/formaldehyde waste was spiked with a variety of phosphate, sulfate and chloride salts, to maintain the pH and provide additional nutrients for microbial growth.

Operating at 34°C, the microbes biodegraded an average phenol concentration of 583 ppm to non-detectable levels, and the formaldehyde from 108 ppm to 4 ppm. Total organic carbon was reduced to 63 ppm (with biomass removed from the effluent) from a starting value of 768 ppm. 'This 91.8% removal of soluble organic carbon indicates that the phenol and formaldehyde are not being partially degraded to other soluble organics or forming soluble organic polymers' reports Attaway. (*Chem. Eng.*, 12/19/88, p. 19).

HUMAN GENE THERAPY ON THE HORIZON

The first experiment involving introduction of foreign genes into humans got back on track through the institutional review process last December, when it was approved by a sub-committee of the Recombinant-DNA Advisory Committee (RAC) of the US National Institute of Health (NIH).

The protocol calls for treating 10 cancer patients by giving them tumour infiltrating lymphocytes (TIL) marked with genes for antibiotic resistance. The genes will have no therapeutic value to the patients, but will allow the cancer killing TIL cells to be tracked in the patients' bodies.

The NIH institutional biosafety committee cleared the experiment early last November, but cautioned that its approval should not be considered as setting a precedent for allowing human gene therapy.

The protocol must now be approved by the National Heart, Lung and Blood Institute's institutional review board, and be reapproved by the RAC. If it clears both these hurdles, the protocol will then be reviewed by the US Food & Drug Administration (FDA) and the NIH Director. (*Nature*, 12/18/88, p. 96).

RESEARCH ON *BACILLUS THURINGIENSIS* PIONEERED BY GSFC

Researchers under Dr. Kanu Patel at GSFC (Baroda, Gujarat) have pioneered research on *Bacillus thuringiensis* (BT) for developing biopesticides based on this microorganism. Bt have the potential to eliminate many insect pests, and much research is in progress abroad, particularly in USA and Japan.

The Bt strains have been found to be effective against a wide variety of pests affecting cotton, tobacco, sugarcane, vegetables, groundnut, pulses and oilseeds. New strains of Bt can be developed by genetic engineering. Researchers at GSFC have isolated some strains of Bt against certain insect pests, such as those affecting silk worms. The primary hurdle facing researchers lies in developing a strain of Bt harmless to silkworm larvae. Some strains of Bt developed kill the larvae of silk worms together with those of harmful pests. This could create serious problems to sericulture. The challenge before researchers is to widen the base of Bt so as to increase its pesticides activity towards a wide spectrum of pests. In other words, the objective is to develop a specific strain of Bt to act against the specific insect pest or a group of insect pests. Success in this direction can lead to a number of effective biopesticides based on Bt.

JAPANESE BIOTECH PROJECT FOR PRODUCING HEAT-RESISTANT ENZYMES

The Japanese Ministry of Agriculture, Forestry and Fisheries is reported to be planning to launch a protein-engineering project. Due to start in April 1989, the four year project is intended to conduct research into producing heat-resistant enzymes for veterinary vaccines and food processing. Work will be carried out at research organizations under the auspices of the Ministry which is providing funding of 100 million yen. (*Animal Pharm.*, 12/16/88, p. 17).

CATTLE BREEDING POISED FOR A REVOLUTION

The in-vitro fertilization technique (IVF) developed by Animal Biotechnology Cambridge Ltd. (ABC) is just the first step in a revolution in cattle breeding according to the recent report from Milk Marketing Board (MMB), UK. The MMB is to market frozen three quarter beef embryos produced by ABC. The commercial service should begin in 1989, in a small way to begin with. ABC's Scottish embryo produc-

tion site, which was commissioned in October 1988 is now on stream. Trials are currently under way on farms in Cheshire with some 100 pairs of embryos having been implanted. It is too early to access the results of the trials, very variable results have been obtained so far, and more animals need to be implanted before a full evaluation can be carried out.

The current technique will never be able to provide sufficient embryos to compete with artificial insemination (AI). Some one million beef AIs are carried out each year in England and Wales by the MMB, while the IVF technique could produce only about 10,000 embryos a year. The eggs for fertilization are taken from heifers at slaughter, so that there is a limit on the number which can be obtained. Far larger number of embryos can be obtained by cloning, however. At the moment, this is only possible in the laboratory, but within 3 to 5 years, it should become a commercial reality. This, combined with embryo sexing, could have tremendous advantages for both the beef and dairy industries.

The MMB (UK) is very keen on the purchasing of Premier Breeders (leading animal breeder in UK). The MMB has been exploring the possibility of commercial cloning for some time and therefore is keen on acquiring Premier Breeders. With the development of embryo technology and the probability of commercial cloning in the not too distant future, researchers at MMB believe that an intensively selected nucleus herd using the Multiple Ovulation and Embryo Transfer Technique (MOET) will give the means of providing dairy farmers with the highest quality genetic material in the coming years. (*Animal Pharm.*, 12/18/88, p. 21).

THE RATE OF PEPTIDE HYDROLYSIS IN PURE WATER CLOCKED

The extremely slow rate of hydrolysis of an unactivated amide at room temperature and neutral pH has been measured for the first time by chemists at Columbia University. Until now, the rate of amide hydrolysis under neutral conditions had been estimated from experiments on activated analogue or extrapolated from rates measured under more vigorous conditions.

The University researchers have developed an assay for measuring the cleavage of a radio-labelled glycine residue from a peptide bound to a polyacrylamide. They measured the amount of radioactivity that is released from the resin into solution over time as a means of detecting the hydrolysis of a radio-labelled amide.

They found a rate of 3 x 10 per sec, which corresponds to a half-life of approximately 7 years. Knowing the neutral hydrolysis rate should allow researchers to assess the performance of synthetic enzymes designed to hydrolyze amides. (*J. Am. Chem. Soc.*, 110, 7529, 1988).

ALGAE AND BACTERIA HARNESSED TO DISPOSE PIG MANURE

The combined efforts of algae and bacteria could provide a solution to the Dutch pig manure mountain. Researchers at West Scotland College have developed a process that acts like a miniature eco-system in doing exactly what nature would do with the waste -- but in a limited space and without harming the environment. In Holland because of mass scale breeding of pigs there is the problem of surplus pig slurry (faeces) causing much ammonia pollution in the environment as well as obnoxious smell.

The pig slurry is rich in organic matter, which uses large amounts of the dissolved oxygen in fresh water as it decays and in nutrients such as nitrogen and phosphorous. These nutrients encourages algae to grow, which also use up valuable oxygen, both at night, when photosynthesis stops and when they decay. Nitrogen in the form nitrates, is also troublesome in fres water supplies.

What researchers have done is develop a process in which bacteria a algae use the nutrients in pig slurry a useful way. Bacteria break down t organic content of the waste to produc heat and the raw materials to feed th algae. The algae then take over and us the nitrogen and phosphorus left behin

The Scottish researchers have built pilot plant that deals with the excremen of 300 pigs and no weaners. The slurr from the pigs collects in a large under gound tank. Every hour some of th slurry is pumped into another tank, th aerobic reactor, which holds about 2 cu. metres of liquid. A motor driven aerator keeps the oxygen at the right level for the various bacteria to get to work on the organic matter.

In the reactor, the bacteria produce heat, carbon dioxide, ammonia and other nutrients. The heat is siphoned off and transferred to warm the pig house, while the CO_2 is released into the air. By the time the temperature inside the reactor reaches about 35°C, the nitrifying bacteria have converted all the ammonia into nitrate. This is the best form of nitrogen for the algae to use. After about two and half days in the reactor, the slurry is pumped out and allowed to settle. The result is a liquid that looks rather like cold tea and is virtually odourless. It is now ready for the second stage, the algal pond.

The treated slurry trickles into the pond or raceway, a shallow system of channels where the algae are installed. The Pond about 13 sq. metres in area and 34 cms deep, is open to the air so that sunlight can supply the energy needs of the algae, while the slurry provides the nutrients. An electrically driven paddle keep the algae -- laden solution circulating in the raceway until, after about four and a half days, the effluent overflows into a collection tank.

The slurry is now safe to discard after treatment, the amount of oxygen needs for the final stages of decomposition is reduced by 95% and the algae have removed between 40 and 60 of the phosphorus and nitrogen. The solution left is almost pure water and algae. The Scottish researchers are now seeking sponsors so that they can build a full size plant. They report that the treatment system is not expensive to run - the motors to drive the aerator and the paddle in the algae pond are the only continuous draw on power. Further, the heat recovery system could produce about 4-times as much energy as is needed to power the plant. (*New Sci.*, 11/26/88, p. 52).

SYNTHETIC SILK-MOTH PEPTIDES OPEN UP A NEW SOURCE OF ANTIBIOTICS

Research with synthetic derivatives of moth protein have shown a wide range of anti-microbial activity that may portend a new class of antibiotics. The synthetic peptides derived from the giant silk moth, have succeeded in vitro against more than 30 types of bacteria, viruses, fungi and protozoa, as well as several cancer lines. In the only animal studies, the peptides tamed *Listeria monocytogenes* and *Brucella abortus* in mice.

Researchers at the Louisiana State University have developed several peptides from silk moth such as SB-37, Shiva-1 etc. The peptides SB-37 and Shiva-1 act primarily by piercing the membranes of diseased cells ultimately causing the cells to disintegrate. The proteins also stimulate lymphocyte production and can lyse microbes directly. SB-37 and Shiva-1 are modelled after proteins the moth produces to fend off bacteria. The researchers opine that these wide ranging substances can be modified for use against specific pathogens. Further SB-37 and Shiva-1 have shown effectiveness against *Pseudomonas aeruginoss*, and *Stap. aureus* and herpes simplex-2. (*Med. World News*, 10/10/88, p. 48).

FOREIGN GENE TRANSFERRED INTO MAIZE

Researchers have achieved a long awaited goal -- the transfer of a foreign gene into a major cereal, namely maize. The result marks a new milestone in efforts to apply the techniques of modern biotechnology to the cereals, corn, rice and wheat, that supply much of the world's food supply. These crops have generally not been amenable to the same gene transfer techniques that have worked for other kinds of plants.

Genetically transformed maize plants were obtained from protoplasts treated with recombinant DNA. Protoplasts that were digested from embryogenic cell suspension cultures of maize inbred A188 were combined with plasmid DNA containing a gene coding for neomycin phosphotransferase (NPT II) next to 355 promoter region of cauliflower mosaic virus. A high voltage electric pulse was applied to the protoplasts, which were then grown on filters placed over feeder layers of maize suspension cells (Black Mexican Sweet) and selected for growth in the presence of kanamycin. Selected cell lines showed NPT II activity. Plants were regenerated from transformed cell lines and grown to maturity. Analysis of DNA extracted from callus and plants indicated the presence of NPT II gene.

The above successful gene transfer (described above in brief), means that there is now a direct way for introducing desirable new traits into this cereal, and perhaps into the others as well. For example, researchers have already used gene transfer technology to introduce characteristics such as herbicide, insect and disease resistance into some plants, including petunia and tobacco, but, until now have had to rely solely on the standard methods of plant breeding for producing corn strains with novel characteristics. These methods are often time-consuming and may not be applicable at all if the desired trait is carried by a species that is sexually incompatible with maize. Although the maize plants produced so far by gene transfer have been infertile, this problem is likely to be only a temporary obstacle to the application of the technology to corn.

The new found ability to regenerate maize and also rice protoplasts means that these cereal plants have become amenable to a number of biotechnology procedures in addition to gene transfer. For example, protoplast fusion is another way of producing hybrids of plant species that may be sexually incompatible. Moreover, whole chromosomes or organelles such as chloroplasts can be introduced into protoplasts as a way of conveying properties that are encoded by many genes or by chloroplast genes. Resistance to some herbicides is an example of the latter. If all this may now be achieved for rice and corn, will wheat be far behind? (*Science*, 4/8/88, pp. 145, 204).

AMINO ACID DETERMINED BELOW 10^{-18} MOLE

Canadian researchers have dramatically improved the sensitivity with which fluorescent derivatives of amino acids can be detected. The 'relatively simple' analysis method developed by the University of Alberta researchers, combines the high separation efficiency of capillary zone electrophoresis with the high detection sensitivity of laser-induced fluorescence.

The method determines fluorescern isothiocyanate (FITC) derivatives of amino acids at extremely low levels. In the worst case, the smallest amount of lysine that could be detected was 1.5×10^{-19} mole. The best detection limit was achieved for arginine -- less than 9×10^{-21} mole. The limit corresponds to fewer than 6000 arginine molecules injected onto the column, the scientists say. The detection limit 'represents an improvement of four orders of magnitude over the previous state of the art for amino acid analysis' they report. (*Science*, **242**, 562, 1988).

The Changing Atmosphere

H.C. KHURANA*

Chemical pollution is changing the structure of the earth's atmosphere threatening to alter the environment by building up greenhouse gases and exposing human population to higher levels of dangerous ultraviolet radiation.

The earths atmosphere contains 21% oxygen and 0.032% carbon dioxide by volume, a ratio of 650:1. Man's activities, including burning of fossil fuels, land clearing and making cement from limestone are increasing the carbon dioxide content in the air by about 100 million tons a year. Inspite of its relatively small concentration, carbon dioxide plays a vital role in determining the temperature of the planet. The global warming phenomenon is the greenhouse effect. Predicted by Soviet scientist, Mr. Budyko in the early 1970s, it is today a cause for world concern for it has been estimated that by 2030, the increase in the carbon dioxide in the atmosphere would increase the world temperatures by about 4°F (2°C) from the level of 1860. (See Fig. 1).

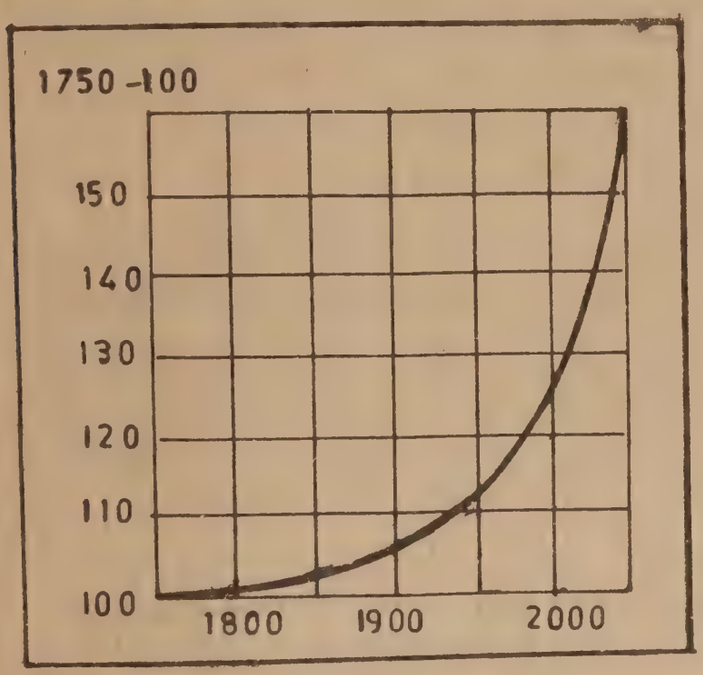


Fig. 1

While fossil fuel combustion has spewed 150 to 190 billion tonnes of carbon dioxide into the air, forest clearing has contributed an additional 90 to 180 billion tonnes. Deforestation is an important source of gas build-up. Living trees mop up carbon dioxide. When the trees are cut down and burnt, another 1.5 billion tonnes of carbon dioxide gas is released a year.

According to "State of the World 1988", Worldwide Institute report says that India lost nine million hectares of tree cover -- roughly 1.3 million hectares every year. At this rate, India will lose most of its remaining 31 million hectares of forest by the end of the century.

* The Author is presently working as Production Manager, Camphor & Allied Products Ltd., Clutterbuckganj, Bareilly 243 502, U.P.

THE GREENHOUSE PROBLEM

The atmosphere that surrounds the earth, plays a critical role in maintaining even temperature on the earth's surface. Like the glass in the green house, the atmosphere absorbs some of the long-wave radiation emitted by the earth and radiates energy back at the earth.

But, industrial activity is changing the atmospheres structure. As gases like carbon dioxide are produced and released into the atmosphere, they absorb more of the earth's radiation and return more of it back to the earth. This energy which would otherwise escape harmlessly into space, is already increasing the earth's surface temperature, so far by only small amounts (0.5°C in the past 120 years). Carbon dioxide is the most important of the greenhouse gases and is produced primarily when fossil fuels are burnt to provide power. Levels of carbon dioxide in the atmosphere have already increased by some 25%. Since the industrial revolution, they are expected to increase by further 30% in the next 50 years.

Many other gases also have a greenhouse effect. These include nitrous oxide (laughing gas), methane, ozone and chemicals used in refrigeration and other industries called chlorofluoro carbons (CFC). The concentration of these gases in the atmosphere are much lower than that of carbon dioxide but they are increasing and many of them can produce greenhouse effect. Scientists calculate that over the next half century or so, the temperature rise produced by increasing concentration of carbon dioxide will be matched by the effect of the other greenhouse gases. The carbon dioxide effect, in other words, will be doubled. Current predictions are that the greenhouse effect will amount to between 1.5 to 4.5°C by the year 2030. (See Fig. 2 on p. 82).

OZONE, THE UMBRELLA AGAINST THE ULTRAVIOLET

Ozone, a gas composed of three oxygen atoms, surrounds the earth like a delicate veil, protecting the planet and its inhabitants from the direct gases of the sun. Ozone is our umbrella against the ultraviolet.

Ozone is found upto heights of about 60 km. It is most dense at 20-25 km height but even here also only one molecule in 1,00,000 is ozone. If all the ozone is collected at the earth's surface, it would form a layer only 3 mm thick.

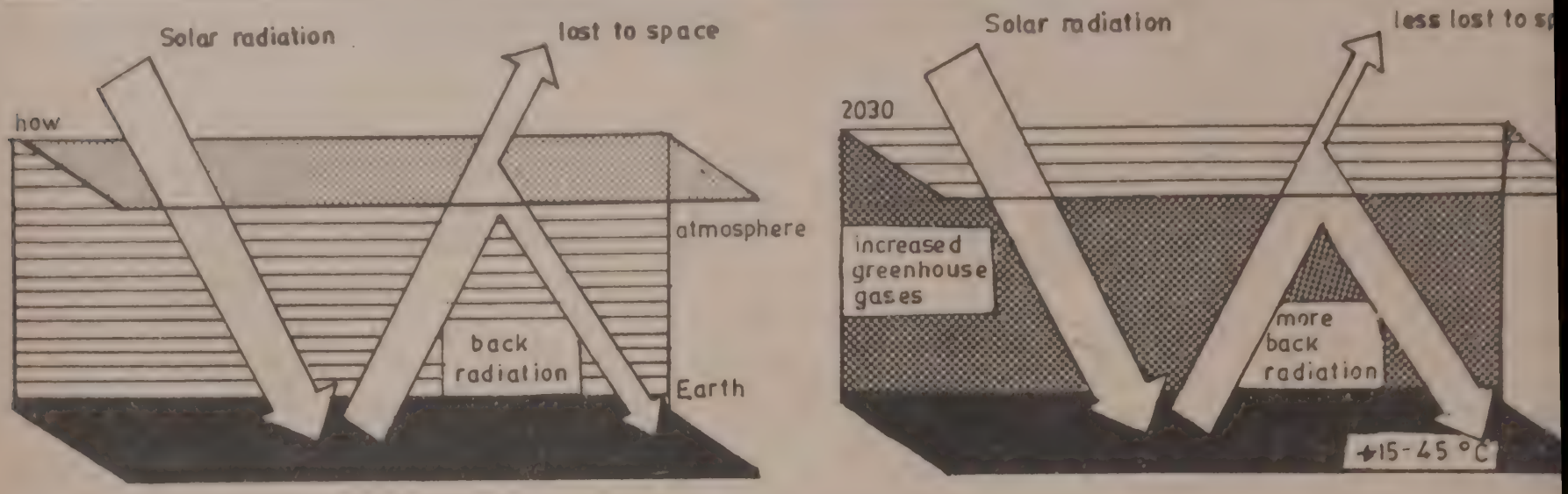


Fig. 2: How greenhouse gases increase the Earth's temperature

But because there is so little of it and because its presence is so important, small changes in the ozone concentration could have dramatic effects on life on earth.

Ozone is produced naturally from oxygen, high in the atmosphere. Natural forces also break it down with the result that the gas is constantly being created and destroyed. The speeds at which these reactions occur determine how much ozone there is in the atmosphere. And these speeds can be influenced by chemicals in the atmosphere which act as catalysts in the reactions, speeding them up without themselves being destroyed (See Fig. 3).

Several chemicals used in or produced by industry greatly affect the speed at which ozone is broken down. These include the chlorofluorocarbons (CFC) which are used as the propellants in aerosols in refrigeration technology, as foam blowing agents in the plastic industry and as solvents in electronics. Other gases that speed up the breakdown of ozone include nitrous oxide and those containing chlorine, fluorine and b mine etc.

The latest results on this work suggest that ozone lev will fall by a few percent during the first half of the n century -- although increase in CFC emissions could ca more than 10% fall in ozone. Changes of a few percent ozone levels would be enough to let substantially more ult violet radiation reach the earth's surface.

WHAT COULD HAPPEN?

The greenhouse effect and ozone depletion are not co pletely separate problems. Three separate effects are involve

1. Climatic change.
2. Abnormally fast plant growth caused by high levels carbondioxide in the air.
3. Increase level of ultraviolet radiation.

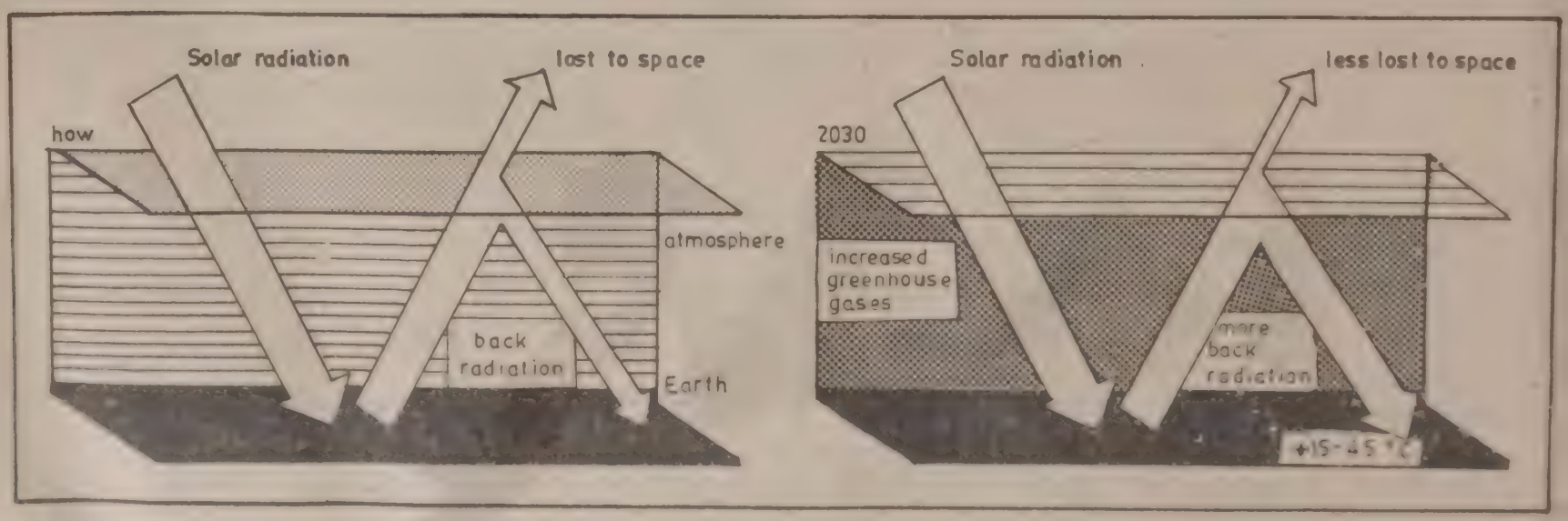


Fig. 3: The ozone layer: Less ozone means more ultraviolet

Climatic Change

The earth's climate has not varied by more than 1 or 2°C in the past 10,000 years. The warming expected in the next 50 years will thus exceed any climatic change. While warmer temperatures speed crop growth, they do not necessarily lead to higher yield; muggy conditions, for example provide ideal breeding grounds for pests and diseases. This would lower wheat production by 25%, resulting in a fall in employment and gross domestic product.

The natural eco-system would also be disrupted with grasslands and deserts expanding in areas and forest areas growing smaller. Climatic changes might also exacerbate existing problems such as desertification, drought and soil erosion. Ecological hazards such as floods, storms and forest fires might become more common and warmer winters could enable more pests to survive winters in which they would have perished (See Fig. 4).

The world cycle is likely to be profoundly influenced by the greenhouse warming, with rainfall increasing in many areas but with soils becoming drier as evaporation rates increase. All this would have a major effect on surface water run-off, and many dams, reservoirs and hydro-electric schemes might become useless. Planning would become impossible/difficult if the climate began to change fast. (See Fig. 5).

One of the main dangers of a warmer climate is flooding from rising sea levels and then they will expand. Scientists calculate that this expansion could cause a rise in sea levels of between 20 and 140 cm if the average temperature increases by between 1.5 to 4.5°C, a temperature rise in the middle

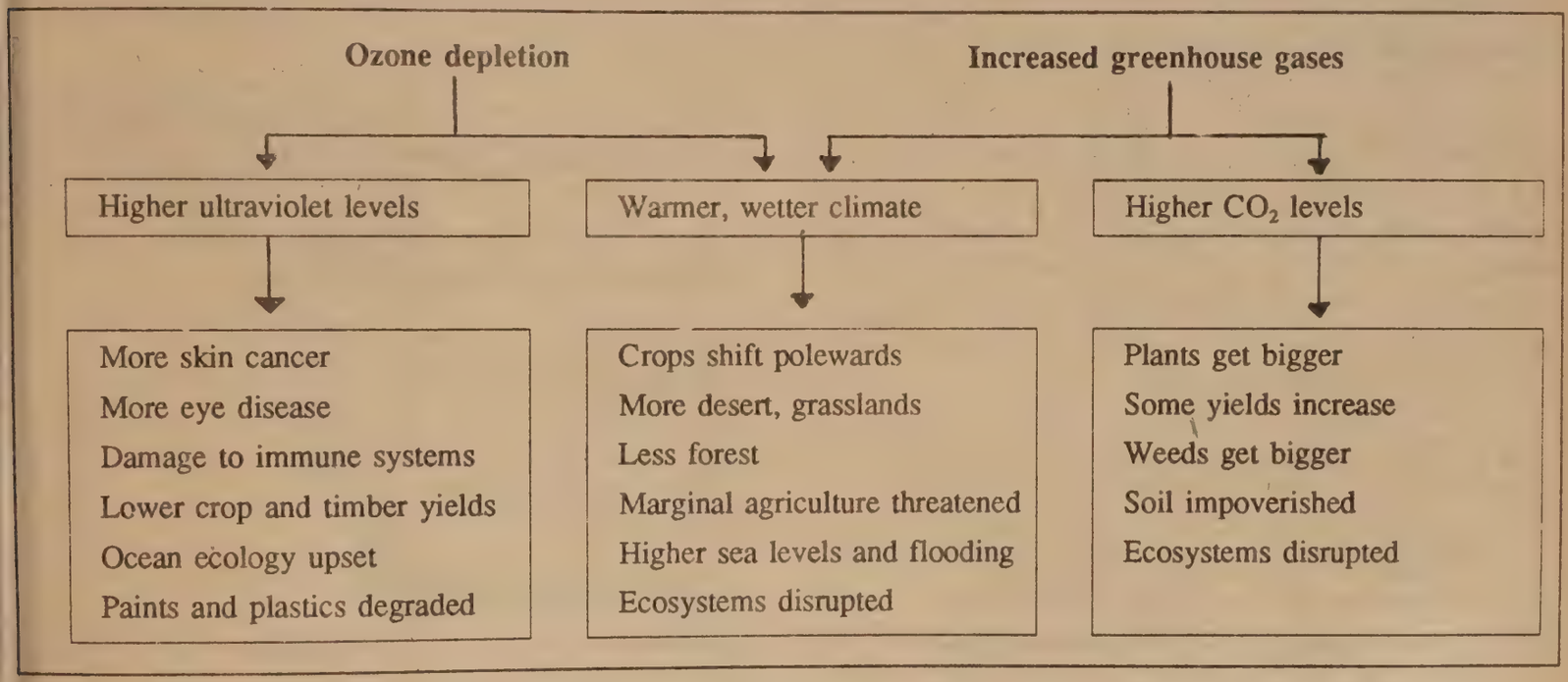


Fig. 4: Social effects of damaging the atmosphere

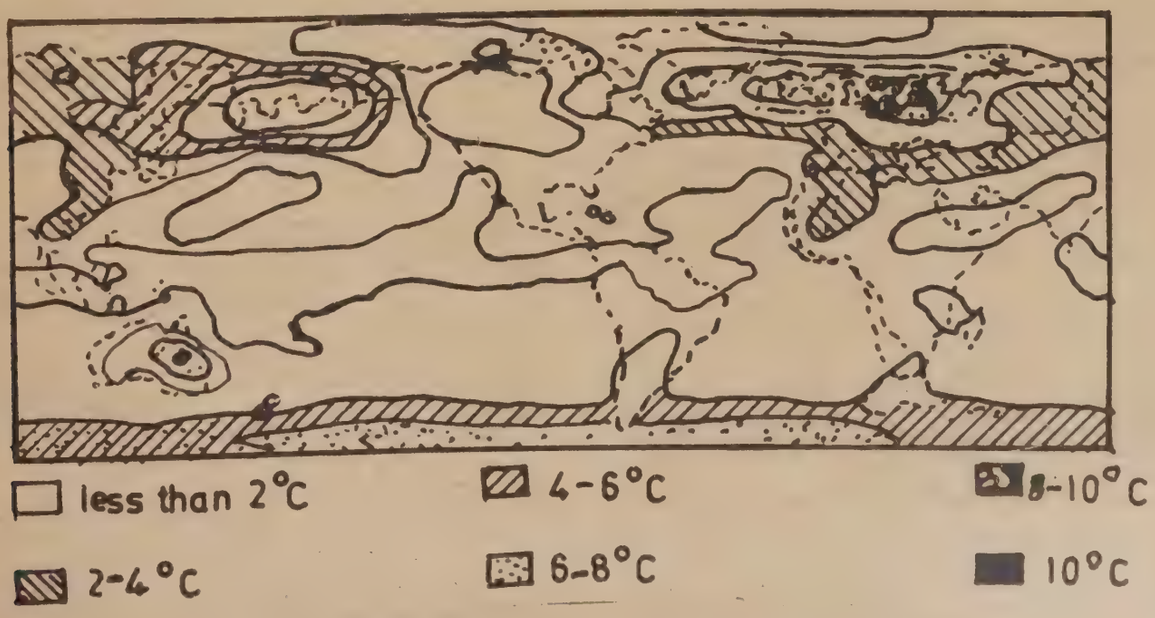


Fig. 5: How temperatures might rise (winter, Northern hemisphere)

of this range could increase sea levels by about 80 cm, more than enough to flood huge areas of unprotected coastal land.

Nearly one-third of all human beings live within 60 kms. of a coast. A rise in sea level of even half a metre could, therefore, have profound effects on habitation patterns, causing many people to more and many of the world's most important cities and ports to come under threat of flood.

Dr. Rashmi Mayur, President of Bombay-based Global Future Network pointed out recently in his paper that if the sea level rises upto 50 kms. along the coast, then fifty percent of Bombay and one-third of Bangladesh will be under water. Maps show how far the sea would invade Bangladesh with a 50 cm rise (top) and a 2.0-2.5 M rise (bottom). (See Fig. 6).

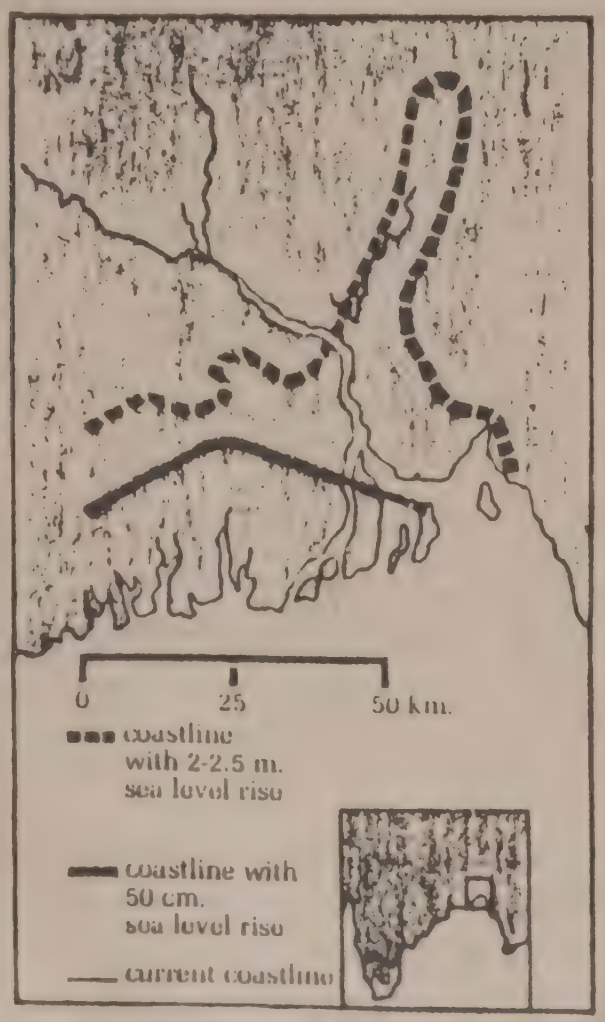


Fig. 6

Plants would grow faster and larger

Because carbon dioxide is a natural fertilizer, plants will grow faster and larger in a higher carbon dioxide world. If carbon dioxide level double -- as they may do by later in the next century -- the yield of many crops and weeds could increase by an average of about a third.

Plants have widely differing responses to increased carbon dioxide, so it is difficult to predict what effects this could have on agriculture. Yields of some crops could even double while those of others changed very little. Response depe on how a plant photosynthesizes. Plants that produce in mediate chemicals with three carbon atoms, the carbon (plants respond well, those that produce intermediate with f carbon atoms (C_4) plants, much less so.

Of the world's 20 major food crops, 16 are C_3 plants. T other four -- maize, sorghum, millet and sugarcane -- carbon (C_4) plants whose yield would not be expected increase greatly. Unfortunately, three of these are the sta foods of Africa where food is already in short supply.

Bigger plants with larger yields could raise other proble too. Unless larger amounts of expensive fertilizer were us the soil might well become impoverished as it struggles provide the nutrients required by an increased crop cover (S Fig. 7).

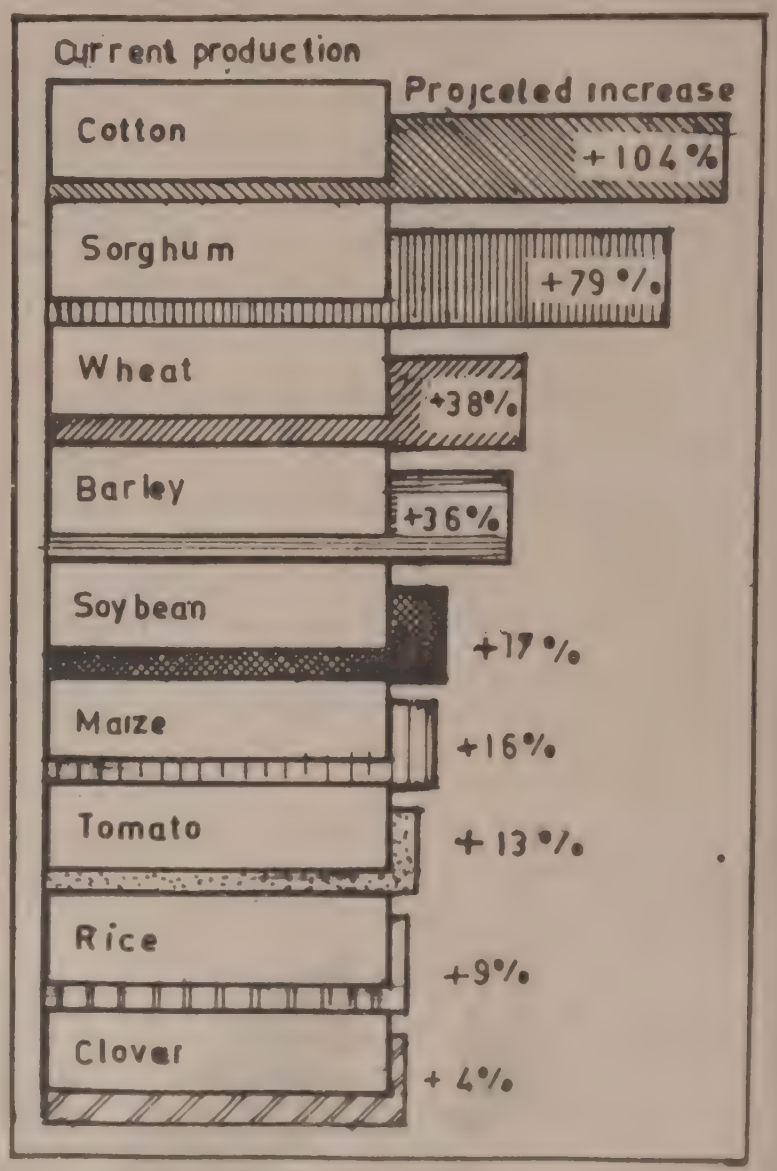


Fig. 7: How yields might increase if carbon dioxide levels double

Ultraviolet increases

If ozone levels are depleted by a few percent early in the next century, there will be increased levels of a portion of the spectrum known as UV-B on the earth's surface. Currently between 10 and 30 per cent of the sun's UV-B reaches

he earth's surface. If ozone levels were to fall by 10%, the mount of UV-B reaching the earth would increase by about 20%. UV-B causes skin cancer and eye disease in the man, lows down plant growth, is lethal to marine algae and breaks lown chemical structure of paints and plastics.

Some 200 species of plants have been tested for sensitivty of UV-B and about two-third of them respond -- growth s slower and pollen may fail to germinate. A 25% ozone depletion, for example, would be expected to lower soyaean yields by 25%. Fish and the algae on which they feed, may also fare badly and upset marine ecology. Worldwide, ish currently provide 18% of all the animal protein consumed. Even today's levels of sunlight provide enough UV-B to cause substantial economic damage. It is UV-B that causes paints to fade, window glazing to yellow and car roofs o become chalky. These kinds of degradation will accelerate if the ozone layer is depleted.

Finally, more UV-B will mean more smog -- an effect that will be accentuated if temperature rises as a result of greenhouse warming.

WHAT CAN BE DONE?

International action is urgently required to minimise both uture greenhouse heating and ozone depletion. Because it akes decades for human actions to produce any affect on he structure of the atmosphere, a start has to be made now.

There are four possible solutions to the green house problems:

- Reduce the rate at which fossil fuels are burnt and other greenhouse gases produced.
- Dispose off the greenhouse gases as they are produced elsewhere than in the atmosphere.
- Recover the greenhouse gases already in the atmosphere and dispose off them elsewhere.
- Accept the changing climate and adapt to it.

Carbon dioxide, for example, could be filtered from power tation effluents, converted to other chemical form and dumped on the ocean floor. But the cost would be enormous. Carbon dioxide which is already in the atmosphere could, n theory be 'mopped up' by planting more trees on the earth which wo ıld convert carbon dioxide in the atmosphere into woody tissue for which more area and size is required to compensate for the current rate at which carbon dioxide is produced. Even if these were possible, the effects of the other greenhouse gases would still change future climates.

The most promising ways to consume less fossil fuels is by relying increasingly on nuclear and solar energy. Action has already been taken to protect the ozone layer. Because the major danger comes from the chemicals called chlorofluorocarbons (CFC) and because they are widely used as the propellants in aerosols. A product Du Pont's USA has developed -- HFC-134A -- an alternative substitute to chlorofluorocarbons (CFC) is being studied in their R & D Centre and is on its way as a replacement to CFC. Union Carbide, USA has developed a new technology in which use of chlorofluorocarbon (CFC) is totally eliminated in the manufacture of flexible urethane foams.

Furthermore, a convention for the protection of the ozone layer was adopted in Vienna in March 1985 by 21 states and the E.E.C. The convention pledges parties to it to protect human health and the environment from the effects of ozone depletion.

INDIA'S ENVIRONMENT (PROTECTION) ACT, 1986

In June, 1972 United Nations Conference on the Human Environment was held in Stockholm in which Government of India participated and strongly voiced concern about the environment. While several measures have been taken for environmental protection both before and after the conference, the need for a general legislation further to implement the decisions of the conference has become increasingly evident.

HOW 'UNEP' IS HELPING?

United Nations Environment Programme (UNEP) is working with Governments, International Organizations and industry to develop a framework within which the international community can make decisions to minimise atmopsheric changes and the effects they could have on earth.

In 1977, UNEP convened a meeting of experts to draft the world plan of action on the ozone layer to study what would happen if the ozone layer is damaged. To coordinate this programme, UNEP created a special body, the Co-ordinating Committee on the Ozone Layer (CCOL). UNEP also took action to tackle the greenhouse problem early in the 1970s when the organization joined forces with the World Metereological Organisation (WMO) and the International Council of Scientific Unions (ICSU) to place study on the greenhouse effect on a firm scientific footing.

REFERENCES

1. *Encology*, Vol. 3, No. 2, July 1988.
2. The Greenhouse Effect, Neelam Mathews, *Hindustan Times, New Delhi.*
3. *The Environment (Protection) Act, 1986.*
4. *Chemical Weekly*, No. 7, 8 & 10, Vol. XXXIV.

CHEMICAL WEEKLY
BUYER'S GUIDE
EIGHTH EDITION

Four years after the publication of our last ***CHEMICAL WEEKLY BUYER'S GUIDE,*** *(Seventh Edition)* we at **SEVAK PUBLICATIONS,** are pleased to announce our plans for publication of the Eighth Edition.

The last four years have seen a considerable growth in the chemical industry, both in terms of size and range of products manufactured, traded or imported. Consequent to such a growth has arisen an imperative need for a systematic source-book to detail the activities of the industry all over the country.

The ***CHEMICAL WEEKLY BUYER'S GUIDE, EIGHTH EDITION*** coming in the tradition of seven previous editions strives to fill this gap.

A glance at the proposed list of contents will reveal that the ***GUIDE*** will be a valuable reference book to all those involved in the industry be it in manufacturing or trading.

As a forum for advertising your activities the ***GUIDE*** will remain unsurpassed. The tariff rate for advertising in the ***GUIDE*** is detailed in the last page of the brochure.

We request you to reserve the space required by you and send us the material for your advertisement at the earliest to enable us to give it a position of vantage.

PROPOSED LIST OF CONTENTS

The ***BUYER'S GUIDE*** will include comprehensive listings of:

* Chemical Manufacturers
* Chemical Dealers
* Indenting Agents

All the above will be suitably and conveniently indexed so as to permit easy and rapid access to information.

In addition, it is also proposed to cover the following:

* Chemical Plant & Equipment Manufacturers
* Consulting Engineering Firms
* Instrument Manufacturers
* Instrument Dealers
* Associations and their members
* Items reserved for small scale sector
* Journals & Periodicals
* Educational Institutions
* Indian Standards
* N.R.D.C. Processes available for commercialisation
* R & D Units recognised by the Department of Science & Technology
* Major chemical manufacturers worldwide and particularly in U.S., Europe and Japan.

CHEMICAL WEEKLY BUYER'S GUIDE EIGHTH EDITION

SPACE ORDER FORM

From

To

The Advertisement Manager,
CHEMICAL WEEKLY BUYER'S GUIDE
SEVAK PUBLICATIONS,
306, Shri Hanuman Indl. Estate, G.D. Ambekar Road,
Wadala, Bombay 400 031.

Dear Sirs,

Please reserve for us in the *CHEMICAL WEEKLY BUYER'S GUIDE*

FULL PAGE ☐ **HALF PAGE** ☐ **ONE-THIRD PAGE** ☐

for our advertisement. Our cheque/advertisement material for the above insertion is enclosed herewith.

Yours faithfully,

(Signature with stamp)

ADVERTISEMENT TARIFF RATES

The following are the tariffs for the *CHEMICAL WEEKLY BUYER'S GUIDE:*

INSIDE PAGES

Full Page	...	Rs. 3,000
Half Page	...	Rs. 1,500
One-third Page	...	Rs. 1,200

COVER POSITIONS

Front Cover	...	Rs. 15,000
Second Cover	...	Rs. 10,000
Third Cover	...	Rs. 8,000
Back Cover	...	Rs. 12,000

TECHNICAL DATA

Overall Size	...	27.50cm x 21.25cm
Printed Page Size	...	22.50cm x 17.50cm

Screen to be used -- 80°; Art-work and Films preferred. Blocks, Positives accepted.

For rates for special positions, such as Page 1, Opposite Contents, or facing any special features like Product Index etc. please contact:

The Advertisement Manager
CHEMICAL WEEKLY BUYER'S GUIDE
SEVAK PUBLICATIONS

306, Shri Hanuman Industrial Estate, G.D. Ambekar Road, P.B. No. 7110, Wadala, Bombay 400 031.
Phones: 4131198 / 412 0743 * Telex: 011-76053 CWLY IN

Madras Office:

27, Begum Saheb Third Street, Mount Road, Madras 600 002.
Phones: C/o. 831808 / 419265 * Telex: 041-6290 CWLY IN

CHEMICAL WEEKLY BUYER'S GUIDE

EIGHTH EDITION

SEVAK PUBLICATIONS

306, Shri Hanuman Industrial Estate, G.D. Ambekar Road, P.B. No. 7110, Wadala, Bombay 400 031.

Plans are now afoot to bring out the Eighth Edition of our **CHEMICAL WEEKLY BUYER'S GUIDE.** Among the many features being planned is a comprehensive listing of manufacturers/dealers/indenting agents of chemical and allied products, chemical plant & equipment, instruments, machinery etc. To make the **BUYER'S GUIDE** an authentic source-book we seek your co-operation. Kindly fill in this questionnaire and return it to the address shown above, as early as possible. **PUBLICATION OF YOUR ENTRY IN THE BUYER'S GUIDE IS ENTIRELY FREE AND WITHOUT ANY OBLIGATION.** When filling up this questionnaire be as detailed as you please. For convenience of indexing do not use abbreviations for chemicals and use only generic names. Trade names where mentioned should be accompanied by generic names. If space in this form seems insufficient do not hesitate to give details separately.

ENTRY FORM FOR MANUFACTURERS/DEALERS/INDENTING AGENTS
(Select appropriate one)

Name of Unit :

Office Address (with Telephone & Telex numbers and Telegraphic Address) :

Factory Address (with Telephone & Telex numbers and Telegraphic Address) :

Branches :

Established in :

Foreign Collaboration/Associates if any :

Products (Trade names if mentioned should have the corresponding generic name alongwith. Dealers are requested to restrict entry so as to include their major items) :

Installed Capacity
(Item-wise in tonnes per annum) :

Production in Last Financial Year
(Item-wise in tonnes per annum) :

Exports if any
(with details of country exported to, quantity, value etc.) :

Raw Materials Required
(Item-wise in tonnes per annum) :

For Dealers only :
Acting as stockists for :

Executives :

Any other relevant information :
(Membership of Associations/Awards etc.)

CHEMICAL WEEKLY
SUPPLEMENT ON

LEATHER PROCESSING

LEATHER FINISHES

R. PRABHU

Central Leather Research Institute, Madras

The term 'leather finishing' relates to a wide variety of operations carried out essentially on dry leather subsequent to the tanning operations. These post-tanning unit operations and processes are aimed at giving leather its final appearance, thus making it more appealing and attractive to its users and also at protecting the leather surface from wear and tear. Finishing perhaps is the most vital part of processing of leathers, as the final products are judged by their appearance. The requirements of the modern finished leathers give scope for the development of new techniques and operations and production of new range of finishing materials both by modification of the available materials and by the synthesis of new materials.

Classificaton of leather finishes

The presently available leather finishes are classified into the following categories:

A. Aqueous finishes
- i) Protein finishes
- ii) Synthetic resin based finishes
- iii) Nitrocellulose emulsion

B. Non-aqueous finishes
- i) Nitrocellulose lacquer
- ii) Polyurethane lacquers
- iii) Solvent based vinyl resins

Requirements of leather finishes

Coating composition for application of any flexible porous substrate must contain a film forming binding component which should withstand mechanical and other stresses the substrate undergoes in the process of being converted into articles and also during its actual use. In contrast to the other substrates to which protective and decorative coatings are applied, leather is unique in its flexibility, porosity etc. In general, the finishes are desired to possess the following properties.

1. Good adhesion to the leather surface.
2. Good flexibility and cohesion to the finish and leather to withstand repeated flexings without cracking or chipping.
3. In the case of leathers to be friction glazed ability to inhibit scorching or tearing during glazing.
4. Good filling properties to cover defects and poor grain, to produce uniform appearance in pigment finishing.
5. Durability against weathering and ageing.
6. Permeability to water vapour and air ensuring the hygienic properties of the leather and the ability of the leather to breathe.
7. Durability against wet and dry rubbing.
8. Good levelling and filling properties.
9. Compatibility with other auxiliaries used in leather finishing.

Since leathers are finished for different end uses depending upon the specific requirements of each class of leather, different materials have to be used in finishing to obtain the required look, feel, gloss, uniformity etc.

Protein finishes

For the finishing of glazed kids, glazed calves, aniline leathers and speciality leathers such as snake and lizard skins, a straight protein finish is desired. A protein finish has the ability to be friction-glazed and on full-grain leathers it imparts a very natural look. The basic principle involved in protein finishing is to lay a coat of some hard proteinous material on the leather surface which after being hardened by treatment with formaldehyde can be glazed under friction to produce a lustrous appearance with a high gloss. The aqueous protein finishes are based on casein, gelatine, egg albumin and blood and are used in conjunction with small quantities of other additives like plasticizers. Casein is the basic material for any protein finish and the albumins are in general used to produce better lustre and fastness. The protein finishes possess the ability to be friction glazed to produce good gloss, unique grain pattern, good adhesion, good air permeability, good water vapour permeability and good dry rub fastness. But these finishes are inferior to other fin-

ishes in wet rub fastness characteristics, flexural and endurance and continuous film formation. The storage stability of these proteinous materials is very low due to their poor resistance to attack by bacteria, fungi and moulds unless preserved with large quantities of preservatives which affect the film forming properties adversely. Attempts have been made to reduce the hydrophilicity of casein finishes by the use of shellac, melamine resins, natural waxes, albumins, formaldehyde etc. The disadvantage of having to use many components and the vulnerability of the physical mixture to separation on storage make the modification of casein by some other chemical means in this respect very desirable.

Synthetic resin binders

Synthetic binders from acrylic and vinyl monomers stand out as products for use in leather finishing. They are applied to leathers either alone or in admixture with pigment dispersions and thickeners. They are used in non-glazeable finishes in the case of low grade leathers requiring grain correction, the proper choice and application of synthetic resin emulsions being imperative. The use of resin emulsions in finishing bestow certain advantages. Synthetic resin emulsions based on acrylic and vinyl monomers form elastic films having the required thermoplasticity to flow under the applications of heat and pressure to form uniform, smooth and glossy coatings in the plating operation. These resins impart a good degree of filling, good break, good adhesion and flexibility to the finished surface. They are internally plasticized and intrinsically elastic and additional plasticization is not necessary to maintain the flexibility on ageing. The resins dry down to water insoluble materials and thus their wet-rub fastness is good. They can be used in aqueous base coats with subsequent lacquer top coat in preference to protein sealing coats and have good compatibility with lacquers and lacquer emulsions. Their main disadvantage is their thermoplasticity which eliminates them for use in glaze finishing. By choosing different acrylic monomers, it is possible to produce resin emulsions of varying degrees of hardness.

Cellulose derivatives based finishes

Cellulose derivatives are used very much in the leather industry. They are (i) Nitrocellulose (ii) Cellulose acetate and (iii) Cellulose acetate butyrate. The advantages of nitrocellulose lacquers are (a) easy application (b) quick drying (c) non-tacky and glossy surface (d) fast to wet and dry rub. The disadvantages are (1) its poor light fastness (2) the flexural endurance is not high (3) poor ageing characteristics (4) its inflammable nature.

Due to limitations of nitrocellulose other cellulose derivatives like cellulose acetate and cellulose acetate butyrate are used in leather finishing. The disadvantage of cellulose acetate is that it is not easily soluble in common commercial thinners. Thinners normally used for nitrocellulose lacquer cannot be used for cellulose acetate. Cellulose acetate b yrate lacquers have excellent light fastness and other desi properties. In India, this material has not been used to great extent. This is due to high cost and non-availabil This finish is mainly used for finishing sophisticated li fast white leathers.

At present, the emphasis is more on the use of nitroc lulose lacquer emulsions. As is well known, lacquer em sions are preferred to lacquers for finishing leathers becau they do not affect the smoothness and feel or handle of leathers. The solvent based lacquers penetrate deep into grain and as a result harden the grain.

Hence, the emulsion type of finish is preferred in finis ing of leathers. In addition for cost and environmental re sons also the current trend is towards using water as the ma diluent for lacquer formulation. The disadvantage of wat based product is that they do not possess high wet and d rub fastness. There are three types of nitrocellulose emu sions available in the market i.e. the water dilutable emu sion, the solvent dilutable product and the emulsion that ca be diluted either with water or solvent.

Polyurethane based finishes

Polyurethane lacquer is used in the preparation of pate type of leather. Polyurethanes are produced by the intera tion of diisocyanates with polyols of different molecul weight. In the market, polyurethane resins are available one component system and also as two component syster

Polyurethane coatings give very high gloss, excellent flex ibility, very good scuff and abrasion resistance and comple fastness to wet rubbing. The disadvantages are (1) longer tim for drying (2) careful attention is necessary in preparing th base coat and the surface must be free from any oil or greas as this may affect the curing of the urethane polymer.

Polyurethane aqueous dispersions are nowadays largel used as binders as well as fillers in leather processes. Thes dispersions are used in combination with acrylic aqueous resi binders to bring down the cost as well as to give improve strength and feel properties to the treated leathers. The rhe ological properties of the polyurethane polymer makes ther suitable material for covering defective Indian cow hides an also for the upgradation of splits and lower ends.

Compact Finishes

Another recent development is the introduction of com pact finishes. The compact finishes enable a tanner to appl rapidly the finish formulation supplied by the chemical com panies. These finishes contain in them the colouring matter polyurethane type binder, lubricants and other material needed to make up the final finished film. These product have become very popular with the tanners.

inyl lacquer finishes

In this type of finish vinyl resin such as polyvinyl chlo-de or copolymers of vinyl chloride and vinyl acetate are sed as a film forming material instead of nitrocellulose. In eneral, vinyls are more difficult to apply and they do not ow out as well as the nitrocellulose or butyrate. However, ey are tougher over a wider temperature range. They find se in automotive upholstery and they exhibit excellent abra-ion resistance at conventional temperatures and good flex-ility at low temperatures. They are used where water proof haracteristics are needed and also particularly for the pre-aration of sports goods leather.

Conclusion

The technology of leather processing is interdependent on he developments in the field of leather chemicals and aux-liaries. Conversion of raw hides and skins into finished eather is a step by step process and each step requiring inputs of a variety of chemicals most specifically finishing auxil-aries. The leather industry is in an upbeat mood with ever exceeding export targets and greater potential for further growth into diversified products profile. Both qualitative and quantitative demands are likely to be imposed on production of chemicals, the demands being exhaustive aand exacting. Thus the chemical sector must gear itself for stupendous chal-enges ahead.

INDIAN LEATHER SCENE

LEATHER EXPORTS BUOYANT: RS. 1,500-CR TARGET MAY BE CROSSED

Leather exports continue to maintain a buoyant trend. It will be no surprise if the target of Rs. 1,500 crores fixed for 1988-89 is crossed again, considering that Rs. 1,340 crores worth of exports have already been achieved in the eleven months of the last financial year.

The leather industry today is perhaps the only vibrant export sector in the country. Every segment of the industry, whether it is finished leather export, or export of leather garments or leather goods, it has been upfront all along the line.

There is no doubt that by 2000 AD, the Indian leather industry will be one of the strongest in the world. There are many significant pointers to this end. First, there is strong awareness that more value added items need to be exported. The awareness is reflected in the fact that more and more investments are being made in setting up footwear (complete shoes) capacities. The investments are being made not merely by those already in the leather business but by many corporate entities by way of diversification. MRF Limited, Thapars and Ponds (India) have made a foray into leather footwear. Many medium sized companies are fast coming up. Many South Korean shoe making companies are looking up to India as a source for locating joint ventures for making shoes, because of a rise in local labour costs. Tanners in many developed countries, particularly the United States, have noted India's potential to emerge as a leading footwear manufacturing country and are exploring opportunities to sell their finished leather.

The environment for footwear exports is also good. It is estimated that more than 50 per cent of all the leather produced in the world today is being converted into a variety of footwear for men, women and children as daily use wares, fashion wares, sports and those for military and paramilitary forces. It is also estimated that by 1990, the demand for leather shoes will be 473 million the bulk of which will be met by imports. The demand is expected to rise in West Germany, Canada, Britain, France, Australia, the Soviet Union, East Germany besides the new importers like Scandinavian countries, East Asia and Hungary.

Leather garments are the next growth area. As much as 10 per cent of the world leather goes into making of garments. There is an argument in knowledgeable circles that the demand for leather articles will taper off since substitutes are bound to be thrown up at relatively low prices. But there is equally a strong view that substitutes will pose no threat to leather exports. If anything, the emergence of substitutes has only helped highlight the uniqueness of leather and its special appeal. Leather is a natural material and is capable of being made tough or soft, tight or loose, heavy or light as the end use demands. It is elegant and can be converted into a variety of products quite easily. The more the substitutes emerge, the more will be the appeal of leather.

It is natural, therefore, that substained investments in the leather industry and new capacities being set up will throw up demand for finished leather. And since the additional demand cannot be made good immediately, there will be pleas for restrictions on finished leather exports in order to divert raw material for the product sector. In fact, product manufacturers have already made such a demand. The finished leather manufacturers have opposed it. They contend that product manufacturers were not fully geared to assimilate all types of finished leathers available in the country and if restrictions are imposed on exports, markets built over the years will be lost. When an industry is in the throes of a change, it is bound to face such imbalances. But the leather industry is bound to overcome such temporary facets and march ahead.

Export of leather and leather products from India
(Value in Million Rs.)

Commodity	April-Jan. 1987-88	April-Jan. 1988-89	Variation %
Semi Finished Leather	248.80	148.27	- 60
Finished Leather	3,948.49	4,592.90	16
Leather Footwear	998.85	888.36	- 12
Footwear Components	2,692.70	3,461.17	29
Leather Garments	867.03	1,158.08	34
Leather Goods	843.15	1,027.02	22
Indl. Leather Manufacturers	102.86	196.32	91
Saddlery & Harness	122.48	132.60	8
Total:	**9,824.36**	**11,604.72**	**18**

PLEA FOR FREE EXPORT OF LEATHER GOODS

The Indian Finished Leather Manufacturers and Exporters Association (IFLMEA) has urged the government not to impose any restriction or regulation on the export of finished leather. Mr. M. Raffeque Ahmed, chairman addressing the sixth AGM of the association, said that going by the avai-

lability figures given by the council for leather exports as well as CLRI there was excess supply of finished leather in the country, of both hides and skins. Besides raw hides from Russia and semi-finished leathers in the form of wet blue, crust and dried skins were also imported.

In these circumstances, the demand of a section of the leather product manufacturers, for putting restriction on exports was unwarranted the IFLMEA chief said.

Mr. Ahmed said in fact the product manufacturers were not fully geared to assimilate all types of finished leathers available in the country. While finished products catered to a part of the globe, the finished leather manufacturers meet the demand from all corners of the world.

He also reiterated the demand that the exemption from sales tax notified in October 1988 by the government be widened to cover "tanning and finishing of hides and skins" so that the benefits accrued to that sector also.

A demand was also put before the government for supply of uninterrupted power to avoid putrefication and damage of leather in process at the tanning and dyeing stage.

FOOTWEAR TEAM VISITS US, CANADA

Footwear and footwear components have been identified as major items of export of leather industry in India. During the last year of the 7th Five Year Plan it is expected that export of these 2 items would contribute about Rs. 710 crores. India's export of footwear and footwear components to the USA during the year 1987-88 was of the order of 56 million US dollars.

The USA is emerging as a major buyer of footwear and footwear components from India. However their demand for footwear is much more than that of components because domestic manufacturing capability has been progressively reducing due to rising labour cost and unwillingness of labour to enter this industry. India's export of footwear to the USA has been showing an encouraging rise but as compared to the size of the US market our share is very small. According to the latest statistics in the year 1987, import of leather footwear into the US was estimated at US $5.75 billion and of footwear components at US $289.5 million.

Over the past 2-3 years considerable manufacturing capacities have been created within India for the manufacture of quality footwear in mechanised factories. Whereas some of these manufacturers are tied to some known importers, most manufacturers are new and are looking for buyers in different countries. The Council for Leather Exports had sponsored a delegation of footwear manufacturers to visit the USA and Canada from 27th March to 8th April, 1989 to explore the possibility of exporting more footwear and footwear components to these countries. The team comprised the following firms:

1. M/s. Shaw Wallace & Co., New Delhi.
2. M/s. Larsen & Toubro Ltd., Bombay.
3. M/s. Liberty Enterprises, Karnal.
4. M/s. Gaja Shoes, Madras.

Shri A. Sahasranaman, IAS, Executive Director of the Council for Leather Exports represented the Council.

The main thrust of the delegation's work was as follows:

1. Meeting leading importers, departmental stores and wholesalers to canvas for orders and to explore possibility of establishing long term relationships.
2. Meeting manufacturers of footwear in the US to find out whether scope exists for increasing export of shoe uppers.
3. Discussions with free lance designers to establish contacts between Indian manufacturers and them.
4. To study the market characteristics of the US footwear market and to explore how best the Indian marketing practices could be improved to tap this vast market.
5. To explore joint venture possibilities.

The delegation will present a detailed report on the visit on its return to the country.

GOOD SCOPE FOR LEATHER GOODS EXPORT TO JAPAN

The Japanese Ambassador, Mr. Bijiro Noda, has said that there is a good scope for increasing leather goods exports to Japan.

Addressing leather goods exporters at New Delhi on April 4, Mr. Noda said so far leather goods exports from India were nominal, and if aggressive marketing promotion is undertaken, India's exports could be substantial. He said the exporters should pay more attention to quality, timely delivery, latest fashions and competitive prices.

The First Secretary (Commercial), Mr. Yoshifumi Saoki, said exports of leather and leather products amounted to $16 million and this could be increased if exports are taken up in an organised manner.

Mr. Saoki suggested that Indian exporters do market search to find out Japanese consumer preferences. He said that Japanese trading companies having offices in India should be contacted.

MANY USES OF TANNERY EFFLUENTS

A recent study conducted in the Madurai district of Tamil Nadu indicates that treated industrial effluents from tannery units can be used to raise good fodder crops.

The study, conducted by the Agriculture College and Research Institute of the Tamil Nadu Agriculture University, found that while the quality of well water near the pollution source deteriorated, the effects of treated effluents were also positive on the soil quality.

A pot culture experiment was conducted with a test crop of ragi in two soil series -- Irugur and Palathurai -- which occupy major areas in Dindigul Taluk of the Madurai district.

The crop was treated at four irrigation levels -- with tap water, 25 per cent tannery effluent, 50 per cent tannery effluent and 100 per cent tannery effluent. The crop was also treated with varying percentage of gypsum added to the effluents.

The study revealed that irrigation with increased concentration of effluent significantly increased soil pH, electrical conductivity, organic carbon and other minerals.

Irrigation with 25 per cent effluent along with addition of gypsum was found to be the best in recording the highest straw yield.

Irrigation with increasing concentration of effluent increased nitrogen, phosphorous and sodium contents. Irrigation with 25 and 50 per cent effluent influenced the nutrient uptake by ragi straw.

Based on findings of the study, researchers suggest that irrigation with water having 25 per cent of tannery effluent could be used for raising good ragi crop. Similarly irrigation with 50 per cent effluent content and with treated effluent only could also give luxuriant foliage growth in ragi crop. Tannery effluent can also be used as a profitable irrigation medium for growing grasses like Giant Napier, which have proved a success under sewage irrigation.

The application of gypsum followed by pressmud also proved effective in increasing available nutrient status of the soil and plants.

L & T GETS GREEN SIGNAL TO TAKE OVER GLI

Larsen and Toubro Limited has received the green signal from the government for taking over Gujarat Leather Industries Limited (GLI), a sick unit. The take-over will be effected through the purchase of 2,35,200 equity shares of the sick company. A 10 rupee share will be acquired at the rate of Rs. 2.50 per share.

L & T is buying these shares from the Ramsinghani Group who, in the opinion of the co-promoters of the company, viz. Gujarat Industrial Investment Corporation (GIIC), "was not taking any active interest in the project".

The GLI was promoted by the GIIC and the state-run Gujarat Agro Industries Corporation to undertake the business of processing of leather (hides and skins). Together, these two companies hold 51% of the share capital and the balance 49% is held by the Ramsinghani Group.

The GLI has been incurring losses for sometime now and become a sick unit. Therefore, the GIIC had approached the L and T group to become its co-promoter in place of the Ramsinghani in order to revive the sick unit.

The total investment of L and T of Rs. 5.88 lakhs will be made out of the internal resources.

Going by L and T's financial strength and other organisational plus factors the government have found justification for giving consent to the take-over of the sick unit.

One condition imposed on the L and T is that it shall fulfill 75 per cent of export obligation for the manufacture of leather footwear and leather goods from the third year of commercial production.

SBI FUND FOR LEATHER SURVEY

State Bank of India, Madras circle, has released Rs. 2.5 lakhs from its export promotion fund to the Central Leather Research Institute (CLRI) for conducting an all India survey on tanneries on behalf of the Council for Leather Exports (CLE).

A cheque for the amount was presented to the Director, CLRI, by Mr. V. Subba Rao, Chief General Manager of SBI on 20th March.

CLE, which has envisaged an export target of Rs. 6,000 crores by 2000 AD for leather and leather products, has commissioned the survey to assess the existing capacity of tanneries, level of modernisation, effluents treatment etc.

As part of the task undertaken by SBI to upgrade the technology in several key industrial sectors, the bank will be covering the leather industry in Tamil Nadu and Uttar Pradesh.

ABSTRACTS

he use of enzymes in soaking, A. Bezak, J. Matyasorsky id V. Janci, ***J. Soc. Leath. Tech. Chem.*** **72,** 145, 1988.

The use of enzyme preparation in the processing of hide leather has assumed importance and there has been a revival of relatively older ideas on the use of enzymes in the intensification of soaking. A small amount of suitable enzyme in a soak enables the amount of absorbed water to be increased per unit of time. This paper presents the results of the use of alkaline bacterial protease based on **Bacillus subtilis** with an enzyme activity of 25,000 enzyme units in soaking. This method of enzyme soaking in the presence of Retar 15 offers the leather producer undoubted advantage. Primarily this is in terms of a considerably enhanced degree of utilisation of hide substance. There is a favourable increase of area yield compared with that obtained by soaking without enzyme. Leather quality is much improved particularly because of the increased softness. A higher yield as compared with the control samples to the extent of 3.32 to 6.02% is achieved.

Sarcopter mange in goats and sheep, Studies on the defects and economic losses resulting from damage caused by the disease on crust leather, K.E.E. Ibrahim and Mukhtar Taha Abw-samra. ***J. Soc. Leath. Tech. Chem.*** **72,** 135, 1988.

A survey of goats and sheep in Sudan for sarcopter mange revealed an incidence of 5.5% and 5.2% respectively. The animals were heavily infested with **Sarcopter scabili** and severe histopathological changes were observed in the skin sections. The disease caused a marked reduction in the aesthetic appeal and cutting area of the leather. In severely infested areas, numerous holes were seen and in some cases, the leather was completely damaged. There was a significant reduction in the tensile strength and apparent density of crust leather. Skins so affected were completely rejected or fetched very low prices resulting in serious economic losses.

Chemical modification of collagen for improved chrome tannage, S.H. Feairheller, M.M. Taylor and E.H. Harris. ***J. Am. Leath. Chem. Assoc.*** **83,** 363, 1989.

Chrome salts are known to tan by bonding with collagen's side chain carboxyl groups as the primary sites for crosslinking. In this paper it has been shown that collagen can be chemically modified by use of the Michael Reaction of ß-carboxyl ethyl acrylate with lysine and hydroxyproline residues to introduce additional carboxyl groups. The treatment benefits chrome tanning by improving chrome uptake and binding. The treated stock had higher shrink temperatures than the control and also had significantly less loosely bonded chrome. Physical properties of the leather were also determined.

Economic vegetable tannery by the C-RFP process, Eperhard Rau, ***World Leather,*** **1,** 15, (8) 1985.

Vegetable tanned leather is currently enjoying high popularity in many sectors, not only in shoe, leather goods and belt industries but also for upholstery leather and strongly vegetable retanned chrome leathers for the vegetable 'look'. This paper presents Bayer's C-RFP process which is not new but offers economic advantages, batch production processing and ecological benefits. The economic advantages include short production time, rapid adjustment to market demands, lower investment costs, no loss of tanning materials due to sludge, mould or fermentation in tanning liquors since there is virtually no residual float and a 10 to 15% reduction in tanning material requirements compared with conventional or accelerated tanning processes. The ecological advantages of the product are that no sludge is formed, less suspended matter occurs and the COD value of the effluent is lower.

Chromeno - High chromium exhaustion process with multiple options, Jurgen Christner, ***The Leather Manufacturer.*** **106** (9) 8, 1989.

The chromeno tanning process is a safe, fool proof system that can be easily modified to suit any type of leather in combination with basic standard chrome tanning agents and syntans. This process achieves good chrome exhaustion and only 0.5-2.0 g/l. Cr_2O_3 is left in residual floats used for unsplit hides. The utilisation of reliable recycling system permits a further reduction of the chrome content to 5.20 ppm. Besides the good chrome exhaustion, full and supple leathers are obtained.

The heterogenous interaction between sulpho-syntans and collagen part II: The parameter of sulphogroup bonding, Z. Vinklanck, Mr. Vondruska and J. Kupec. ***J. Soc. Leath. Tech. Chem.*** **72,** 210, 1989.

The parameter of sulphogroup binding is defined as a variable characterising the number of bonds of Coulomb's type formed. A physico-mathematical model is derived that facilitates the calculation of this parameter on an experimental basis. The parameter value provides an opportunity to decide whether or not a polyelectrolyte complex is formed during the interaction and whether or not the necessary conditions of polyionic network formation are fulfilled.

Enzymes in the tannery -- catalysts for progress? K.T.W. Alexander. ***J. Am. Leath. Chem. Asso.*** **83**, 299, 1989.

This paper highlights some of the possibilities that are now available for exploiting enzymes more effectively in the beamhouse. Commercial trials and production runs have now confirmed the viability of enzyme assisted chemical unhairing under practical conditions and a range of key options are available to the tanner depending on the priorities of production: shortening of time, increased opening up of the fibre structure and the production of softer leather, improved pulping and the production of cleaner grains, reduction of sulphide treatment, and increased area yields.

Polyurethane dispersions, H. Trantel, ***J. Am. Leath. Chem. Assoc.*** **83**, 317, 1988.

The different types of polyurethane dispersions are presented. Due to the high tensile strength and abrasion properties, polyurethanes are able to fulfil finish requirements in thin layers. Aniline type finishes with high fastness properties can be obtained if good colouring pigments are used in combination with aqueous polyurethane.

The effect of trivalent chromium on anaerobic digestion, C.A. Jackson, Miss., J.R. Duncan and D.R. Cooper, ***J. Am. Leath. Chem. Assoc.*** **83**, 389, 1988.

In this paper the effect of trivalent chromium on anaerobic digestion using a synthetic waste containing glucose as the organic carbon source, is presented. It has been observed that an influent concentration of 5000 mg/l trivalent chromium could be tolerated by acclimatised methanogenic bacteria. However, if the concentration in the synthetic waste was further increased, inhibition of the methanogens resulted, with a corresponding decrease in digester performance. These results suggest therefore, that the concentration of trivalent chromium present in tannery effluents and sludges, whic ranges from 1 to 2500 mg/l would have no significant effe on an acclimatised stable anaerobic digester treating thes wastes.

A new polymeric additive and its potential for use i retanning applications, G.J. Waud and H.C. Doyvelaar, ***Am. Leath. Chem. Assoc.*** **84**, 5, 1989.

This paper describes the development of a novel poly meric additive to replace titanium dioxide due to its pric and availability and this resulted in a series of polymers tha are significantly different from the 'normal' emulsion pol ymers known up to now. Practical experience with this pro duct indicates that it can be added before, with or after th fatliquoring procedure. It should, however, be noted that car should be exercised to ensure compatibility when adding th product with fatliquoring agents, since it has been found tha some solvent oils may interfere with product distribution.

A method to convert tannery sludge into a soil extender R.J. Langlais, ***J. Am. Leath. Assoc.*** **84**, 14, 1989.

A plant process has been described which desulfides lime liquor, blends all tannery effluent streams and settles out the solids as sludges. This sludge is concentrated, then treated with bacteria and earthworms to make a soil amender.

An introduction to the CIMple solutions, D.R. Smiedt, ***Apparel International,*** **15** (2), 1989.

Complete control of business information systems --including all areas of the production plant -- is now being achieved through Computer Integrated Manufacturing. In unlocking the door to CIM the author details the vital application to the footwear industry which is easily 'translatable' to its value in other apparel sectors.

NEW PRODUCTS

Less harmful new delimer

A new method of deliming hides, developed in Scandinavia, may result in higher quality skins while reducing environmentally harmful discharges from the tannery and eliminating the heavy manual labour needed at this stage. The new method developed by AGA in co-operation with the Finnish leather manufcturers Viia lan Nakka Oy uses a gas which includes carbondioxide.

Deliming with carbon dioxide results in softer leather with a finer surface structure, partly because CO_2 improves the fat removal process while increasing the ability of the leather to bind with chromium. It also enables the calcium to be removed without the leather becoming loose and weakened. Thus a switch from ammonium salts to CO_2 makes an important contribution in the environmental fight against pollution.

Shoe & Leather News, 3792, 1989

Chrome Syntan

Two new chrome based products have been introduced by Sroppani SpA.

Sintocrome 16/15 is a basic chrome sulphate with complexed synthetic substances, in green powder form, easily sol-

e in hot as well as cold water. It is used for the retanning ll kinds of skins, is not astringent and can be used at tematures upto 50°C. If used alone, it imparts softness, crack istance, silk handle and fine grain and it does not negvely affect either leather grain adhesion power or crack istance contrary to what may occur by using vegetable tang and syntans.

Salcrome M33 is a basic chrome sulphate originally sked, in green powder with high tanning power and easily luble in hot as well as cold water. It can be used for tang and/or retanning of all kinds of skins. Due to its parular characteristics, it gives skins fine grains, excellent ness and a particular wet blue clear colour. It can be ectly used in powder form in the pickle or new bath.

Leather, 191, 4565, 1989

eather resistant leather

Weather Tuff, a leather from the Prime Tanning of the USA claimed to be water proof, impervious to salt solutions, ow and altogether most external climatic influences. It sorbs less than 70% by weight of water, dries quickly and tains its initial softness. It constitutes an inpenetrable barr for water and combines excellent protection against cold en in wet conditions. By applying a sequence of alternate etting and drying cycles the waterproof charateristics and iability of leather are even further improved.

Footwear Digest. Jan/Feb. 1989

ectra Water Jet Cutter

Lectra Systems, one of the world's only suppliers of water cutters, have designed the E 182 model cutter, the time wings of which are dramatic since lay planning and cutting n be carried out simultaneously. The operator can prepare the masker on the first bed using a micro camera to detect faults in the leather, whilst the previous masker is being cut on the other bed after automatic transfer of the latter. The cutting quality is stated as 'superb'. The water generator is designed to produce constant pressure of 4,500 bar and the maximum discharge is 0.5 litres/minute. The fast and easy to use Lectra water jet cutter has several important advantages such as optimum material utilisation for rapid playback, superb cutting quality, quicker throughput for rapid delivery and die savings.

Apparel International, 15, 121, 1989

Livestock in SAARC countries

Livestock development in the countries of the South Asian Association for Regional Co-operation is not seeking attention commensurate with its potential according to reports.

Livestock polulation in SAARC countries, 1987
(1000 head)

	Cattle	Buffalo
Bangladesh	23,000	1,900
Bhutan	345	7
India	199,300	74,260
Maldives	--	--
Nepal	6,374	2,890
Pakistan	16,951	13,698
Sri Lanka	1,807	1,008
Total	**248,327**	**53,763**
World total	**1,277,729**	**138,374**
% in SAARC countries	19.4%	67.8%

In spite of such large cattle and buffalo populations, productivity in livestock in SAARC countries remain low.

Leather 191, 4565,1989

MARKET INFORMATION

Dye Intermediate Prices Shoot

A 10% increase by Atul Products, a leading intermediate manufacturer caused a powerful spurt in the dye intermediates section. However with supply position of HOC materials improving, ready availability was assured at revised prices. In the solvents section melamine stabilised at Rs. 75 per kg. on account of strong supplies. Vinyl acetate monomer went upto Rs. 47.50 following manufacturers price rise.

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent –and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of the market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

(Prices as on April 18, 1989)

INDUSTRIAL CHEMICALS	Per Kg.
Ammonium sulphate	2.00
Ammonium phosphate (Mono)	14.50
Ammonium phosphate (Di)	12.00
Ammonium carbonate (Di)	17.00
Ammonium bicarbonate	5.60
Ammonium chloride	3.00
Ammonium nitrate	6.50
Arsenic white powder	23.00
Acrylamide (Resale)	78+ST
Barium carbonate	6.00
Bleaching powder (33% Cl)	4.20
Borax (Granular)	15.00
Borax (Powder)	15.25
Boric acid (Tech)	23.00
Bisphenol-A	70.00
Butyl carbitol	50.00
Caustic soda (Flakes)	11.00
Caustic soda (Solid)	8.70
Caustic soda (Lye)	6.10
Calcium chloride 70% (Solid)	3.25
Calcium chloride 75-80%(fused)	3.50
Calcium chloride 36% (Anhydrous)	5.00
Calcium carbonate (precipitated)	4.25
Calcium carbonate (Activated)	4.75
Cobalt oxide	280.00
Cresylic acid	45.00
Camphor (Indian)	102.00
Cream of Tartar (Tech.)	70.00
Citric acid (Belgium) (Resale)	48.00
Citric acid (Indian) (Resale)	49.00
Copper sulphate	26.00
Chromic acid	61.00
Ethylene urea	58.00
Ferric chloride (Lumps)	5.50
Ferric chloride (Anhydrous)	16.00
Glue flakes	15.00
Glue sheets	6.75
Gohsenol GH-17	120+ST
Hydro	42+ST

Hyflosupercell	18+ST
Hexamine (Resale)	35.00
Industrial Wax	25.00
Litharge	40.00
Lead Acetate (Tech.)	31.25
Lithopone	18+ST
Magnesium chloride (Crystal)	1.25+ST
Menthol crystal (Flakes)	900+Ex+ST
Menthol bold	665+Ex+ST
Menthol crystal cold	700+Ex+ST
Magnesium carbonate (Japan)	16.00
Magnesium carbonate (Indian)	18.00
Maleic Anhydride (Resale)	37.00
Mercury (175 lbs)	13,000.00
Nickel chloride	110.00
Oxalic acid (Resale)	24.00
Peppermint oil (Rectified)	195+Ex+ST
Potassium carbonate (Indian)	24.00
Potassium carbonate (Imported)	24.00
Potassium bichromate	27+ST
Potassium phosphate (Mono)	14.00
Potassium phosphate (Di)	14.00
Polyvinyl alcohol (No. 117)	120+ST
Polyvinyl alcohol (No. 173)	145+ST
Polyvinyl alcohol (No. 208)	160+ST
Paraformaldehyde (Resale)	23.00
Phthalic anhydride 36% (Resale)	30.00
Pentaerythritol (Resale)	50.00
Paraffin wax	16+ST
Rangolite (German)	80+ST
Rangolite (Czech.)	60+ST
Sodium sulphate (Fine)	6.00
Sodium sulphate (Coarse)	5.00
Sodium sulphide 50-52% (Flakes)	11+ST
Sodium sulphide 58-60% (Flakes) (TCL)	20.00
Sodium sulphide pure (Flakes)	12.25
Sodium nitrite (Resale)	700.00
Sodium chlorite 80% (Spain)	88.00
Soda Ash (Tata)	4.80
Soda Ash (Birla)	4.30
Soda Ash (Imp.)	4.00
Sodium bicarbonate	7.50
Sodium bisulphite	4.50
Sodium silicate	3.00
Sodium acetate	6.25
Sodium alginate	210+ST
Titanium Dioxide (Anatase)	76+ST
Titanium Dioxide (Rutile -- RCR_2)	92+ST
Tartaric acid	102.00
Trisodium phosphate	4.80
Thiourea	80+ST
Urea (Tech.)	2.90
Vacuum salt	1.00
Zinc Dust	30.00
Zinc Oxide	52.00
Zinc chloride powder (Tech.)	12.50
Zinc sulphate	7.00

SOLVENTS	Per Kg.
Acetic Acid Glacial (Resale)	15.50
Acetic Anhydride (Resale)	33.00
Acetone (Resale)	15.00
Adipic Acid	57.00
Aceto Acetanilide	55.00
Aniline Oil	56.00
Benzoate Plasticiser	62.00
Butyl acrylate	78+ST
Butyl stearate	35.00
Butanol	35+ST
Benzyl Alcohol	60.00
Benzyl Chloride	34.00
Benzo trichloride	16.00
Benzoyl chloride	22.00
Bromine Liquid	90.00
Chloroform	30.00
Carbon Tetrachloride	19.50
Cellosolve	54+ST
Cyclohexanone	56+ST
Cyclohexanol	56.00
Diacetone (Resale)	34.00
Diethyl Oxalate	34.00
Diethyl glycol (DEG)	45+ST
Dioctyl Phthalate	45.00
Diallyl Phthalate	56.00
Dimethyl Phthalate	28.00
Dioctyl Adipate	52.00
Dibutyl Adipate	42.00
Dipentene	15.00
Dimethylamine 40%	12.00
Dimethylamine 50%	14.00
Ethyl Acetate	20.00
Ethyl Acrylate	65.00
Ethylene Dichloride	16.00
Ethylene Glycol	46+ST
Formic Acid (Imp.)	26.50+ST
Formaldehyde (Resale)	6.50
Glycerine (CP)	55.00
Glycerine (IW)	50.00
Hydrogen Peroxide 50% (Resale)	28.00
Isopropyl Alcohol	28.00
Isobutyl Alcohol (Resale)	30.00
Monoethanolamine (Resale)	61.25
Melamine	75+ST
Methyl Ethyl Ketone	48.00
Methyl Isobutyl Ketone	42.00
Methyl Acrylate	42.00
Methyl Dichloride (Resale)	26.00

Carbitol	60+ST
Meta Cresol	45.00
Nitrobenzene	30.00
Nitric Acid (Conc.) (RCF)	2.50
Ortho Cresol	30+ST
Phenol (Resale)	36.00
Propylene Glycol	52+ST
Polyethylene Glycol (No.200)	52.00
Polyethylene Glycol (No.400)	54.00
Polyethylene Glycol (No.500)	42.00
Polyethylene Glycol (No.1600)	14.00
Polyethylene Glycol (No.4000)	38.00
Polyethylene Glycol (No.6000)	50.00
Para Cresol	40.00
Styrene Monomer	43.00
Sorbitol	16.00
Sulphuric Acid	2.10
Trichloroethylene	29.50
Triethanolamine (Resale)	58.50
Turpentine Oil (Germany)	8.00
Turkey Red Oil (50%)	20.00
Vinyl Acetate Monomer	47.50

SOLVENTS	Per Litre
Benzene	10.25
N-Heptane	10.50
N-Hexane	12.00
Methanol	9.00
Solvent Naphtha Heavy	10.50
Solvent Naphtha Light	8.50
Toluene	18.25
Xylene	17.50

DYES INTERMEDIATES (PRICES ARE WITHOUT TAX AND EXCISE)

Alphanaphthylamine	63.00
Alpha Naphthol (Imp.)	180.00
Aceto Acetic Ester (Methyl)	66.00
Ammonium Molybdate	220.00
Anthraquinone	120.00
Anthranilic Acid	75.00
2-Amino 4-Nitrophenol	135.00
Blue B. Base (Local)	265.00
Beta Naphthol (Atul)	75.00
Benzidine Dihydrochloride (BDH)	96.00
Bromamine Acid	460.00
BON Acid	140+Ex+Ta
Chicago Acid IRS	325.00
Coach Acid	58.00
C. Acid (Imp.)	190.00
Cyanuric Chloride	155.00
2,4- DNCB	30.00
Dihydrothio PTOS (Imp.)	1,000.00
Dimethyl Aniline	73.00
Diethyl Aniline	170.00
Diamino stilbene disulphonic acid	160.00
3,3-DCB (Imp.)	150.00
Gamma Acid (Atul)	165.00
H. Acid (Atul)	155.00
G. Salt	72.00
Isophthalic Acid	45.00
J. Acid	300.00
J. Acid Urea	365.00
K. Acid	115.00
MPDS (German)	185.00
MNA	110.00
Meta Ureido Aniline	200.00
MPD (Local)	195.00
MPD (Japan)	240.00
Naphthenic Acid	20.00
N-Methyl J. Acid	490.00
N-Methyl Aniline	120.00
Naphthalene (Refined)	24.00
Ortho Anisidine (OA) (Imp.)	105.00
Ortho Dichloro Benzene (ODCB)	14.00
OT Base	110.00
Para Dichloro Benzene (PDCB)	28.00
Para Anisidine (PA local)	135.00
PNA	100.00
Para Cresidine (Imp.)	360.00
Para Amino Azo Benzene (India)	160.00
PNCB	44.00
Para Amino Acetanilide	155.00
1-Phenyl 3-Methyl 5-Pyrazolone	135.00
Phenyl J. Acid	325.00
Para Amino Benzoic Acid	170.00
PT Base	150.00
Rhoduline Acid	525.00
Resist Salt 80%	35.00
Resorcinol	185.00
Sodium Naphthionate	67.00
5-Sulpho-Anthranilic Acid	77.00
Sulphanilic Acid	50.00
Sulpho Tobias Acid	160.00
Trichloro Benzene (TCB)	20.00
Tobias Acid	150.00
Metanilic Acid	64.00
MTD	125.00

Bombay Dyes Market

(prices as on April 18, 1989)

ACID COLOURS	Per Kg.
Acid Violet 4BS	143.00
Acid Maroon V	110.00
Acid Orange II	77.80
Acid Orange IIY	63.05
Acid Red A	107.25
Acid Scarlet 3R	99.90
Acid Red 38N	135.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Patent Blue AS	250.00
Acid Green V	230.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	121.95
Acid Black BX	98.40
Acid Black Wax	135.50
Crosein Scarlet MOO	155.00
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

DIRECT COLOURS	Per Kg.
Yellow 3GX	88.10
Gun Yellow RCH	124.00
Fast Yellow GCH	141.15
Yellow CFG Hly. Conc.	312.00
Fast Yellow GS	111.65
Fast Yellow CHRS	95.45
Viscose Orange A	166.15
Fast Orange GR	133.75
Red	96 90
Dark Tan	78.25
Red IIR	72.55
Red 4B	169.10
Bordeaux BW	132 30
Fast Scarlet 4BS	166 55
Red 12B	170 55
Bordeaux Hly. Conc	194 00
Cotton Red N	117.05
Brill Fast Helio B	278 00
Brill. Fast Helio 2B	297 00
Brill Fast Helio 2RS	136 00
Brill Fast Helio BS	116 10
Brill Violet Extra	126 40
Blue 2B	86.60
Blue G	170.50
Sky Blue FB	188.25
Copper Blue GR	147.00
Fast Greenish Blue GL	114.60
Developed Black BT	116.10
Blue NB-2B	300.20
Blue NB-2BC	185.30
Developed Black NB-GHB	185.30
Green B	111.65
Green NB-B	188.25
Green 2B-N	188.25
Brown MR	154.40
Brown CN	107.25
Golden Brown G	140.35
Catechin G	120.50
Omega Tan	126.40
Catechin GS	102.80
Black E Hly Conc.	142.60
Black E Extra Hly. Conc.	142.60
Black NB-ER Hly. Conc.	310.50

DISPERSOL COLOURS	Per Kg.
Yellow 6G Powder	143.80
Red B 3B Powder	247.80
Red B 2B Powder	323.20
Red CB Powder	439.15
Red D2B Powder	477.40
Violet C 4R	521.90
Blue BG Powder	235.45
Blue BN Powder	103.75
Blue D 2R Powder	476.25
Navy BT Powder	243.90
Blue B 2G Powder	210.20
Blue BT Powder	182.60
Blue BR Powder	390.20
Yellow 7GL	338 60
Yellow 5RX	218 80
Yellow 3G	367.25
Yellow	140.00
Yellow AL	135 30
Yellow Brown REL	247.50
Yellow FFL	463 60
Gold Yellow GG	259.70
Pink REL	247 00
Red REL	468 65
Red 2B	327.40
Red FB	324 20
Red Violet FBL	469 85
Orange 3R	196 65
Violet 3R	280 00
Violet RL	275 45
Violet 6R	485.75
Scarlet RR	214.80
Rubine 3B	223.00
Rubine CB	364.90
Blue GL	318.90
Blue BGF	636.50
Navy Blue RF	270.40
Brown 3REL	200.40
Black GEL	324.20
Dark Brown 3B	317.40

BASE COLOURS	Per Kg.
Fast Yellow GC	80.20
Fast Orange GC	135.45
Fast Scarlet R	166.90
Fast Scarlet RC	126.65
Fast Scarlet RCR	99.05
Fast Scarlet G	121.65
Fast Scarlet GN	91.50
Fast Scarlet GG	72.70
Fast Scarlet GGS	72.75
Fast Red B	203 20
Fast Red RC	119.15
Fast Red R Flakes	149.25
Fast Red TR	166.80
Fast Red TR Oil	183.15
Fast Red RL	237.10
Fast Red KB Oil	201 90
Fast Bordeaux GP	201 95
Fast Garnet GBC	94 00
Fast Violet B	505 60
Fast Blue BB	521 40

NAPHTHOL COLOURS	Per Kg.
ASG	217 00
AS	143 00
ASSW	279 75
ABBS	189 15
ASBO	195 65
ASD	175 50
ASOL	179 35
ASTR	279 75
ASPH	279 75
ASE	196 05
ASEI	184 40
ASLB	1 632 60
ASBT	1 817 00
ASWG	143 00
ASSG	397 70
ASSR	480 50

PROCION COLOURS	Per Kg.
Golden Yellow HR	181.80
Brill. Yellow H4G	117.85
Supra Yellow H-8GP	168.55
Brill. Yellow HE6G	166.95
Yellow G-E4R	276.05
Brill. Yellow H7G	332.30
Yellow M4R	243.95
Yellow M GR	326.05
Brill. Yellow M4G	177.10
Brill. Yellow M8G	332.30
Yellow M 3R	217.60
Brill. Orange H 2R	241.85
Brill. Red H 7B	157.95
Brill. Orange M 2R	313.15
Brill. Red H 8B	169.45
Brill. Scarlet H RN	245.05
Supra Red H-3BP	179.80
Brill. Red H-F3B	243.45
Brill. Magenta HB	167.00
Brill. Red M 5B	98.90
Brill. Red M 8B	173.70
Brill. Pink MB	137.10
Brill. Magenta MB	121.55
Brill. Purple H-3R	180.20
Brill. Purple H-7R	175.40
Navy Blue H 3R	298.50
Brill. Blue H-GR	366.55
Brill. Blue H 5G	173.10
Blue H 5R	283.85
Brill. Blue H 7G	178.70
Brill. Blue H 7RX	358.15
Turquoise HA	234.45
Supra Blue H-3RP	335.70
Supra Turquoise H 2G P	181.50
Blue H-FRD	305.80
Navy Blue H ER	258.60
Blue H 5RX	269.30
Navy Blue M 3R	310.95
Brill. Blue MR	331.70
Brill. Blue M RX	214.20
Brill. Blue M-G	382.30
Blue M 4GD	344.60
Navy Blue M RB	318.75
Turquoise M-G	197.85
Brill. Blue M GX	302.50
Blue 3R Acra Powder	718.20
Dark Brown H 6R	248.45
Cobalt Oxide	285.00
Green H 4BD	269.80
Green H-E4BI	169.80
Red Brown H IF	143.25
Orange Brown H 28	209.05
Brown M GRN	188.80
Black H-N	283.35

SULPHUR COLOURS	Per Kg.
Navy Blue	99.85
Green G	198.55
Black Grains Extra	63.05
Black Grains OG	64.55
Black GXE Conc.	61.60
Black GXE	52.75
Black GXR	61.60
Black Grains 800	54.20
Black EXR Grains	64.55
Black EXR Grains 800	51.25

VAT COLOURS (ICI)	Per Kg.
Yellow 5G Powder Fine	673.15
Yellow 5G Supra Disperse	439.30
Yellow 5G Acra Con.	628.75
Yellow 3R Powder	588.85
Gold Orange 3G Pdr. Fine	952.15
Brill. Orange 6R Pdr. Fine	624.35
Gold Orange 3G Supra Disp.	601.30
Brill. Orange 6RX Powder	394.30
Brill. Red 3B Pdr. Fine	997.80
Brill. Red 3B Supra Disp.	713.20
Brill. Purple 4R Conc. Pdr.	470.75
Brill. Purple 3R Acra Powder	690.85
Brill. Purple 2R Hly. Conc.	597.90
Brill. Purple 4R Supra Disp.	500.05
Brill. Purple 2R Acra Conc.	625.95
Blue R Pdr. Fine	542.15
Blue BC Acra Conc. Pdr. Fine	762.70
Blue BC Conc. Pdr. Fine	522.50
Blue R Conc. Pdr. Fine	577.65
Blue Conc. Powder	645.80
Brill. Blue 2R Hly. Conc.	378.55
Blue RR Supra Powder	629.35
Brill. Blue 2R Supra Disp.	115.65
Dark Blue 2R Powder Fine	389.25
Blue BC Supra Disp.	359.40
Jade Green XBN Powder Fine	438.20
Jade Green XBN Acra Conc. Pdr.	823.90
Jade Green 2G Pdr. Fine	419.65
Jade Green 2G Ptg. Paste	125.40
Jade Green XBN Ptg. Paste	126.00
Jade Green 2G Supra Disp.	496.00
Olive Green B Pdr. Fine	399.90
Olive D Pdr. Fine	444.30
Olive Green B Supra Disp.	308.20
Jade Green XBN Supra Disp. (N)	327.30
Olive OMW Pdr. Fine	698.55
Olive OMW Supra Disp.	538.05
Olive R. Pdr. Fine	422.96
Olive D Supra Disp.	361.70
Olive R Supra Disp.	363.90
Olive D Ptg. Paste	193.00
Olive Green B Ptg. Paste	199.10
Olive Green B Acra Conc.	542.75
Olive R Acra Conc.	640.00
Olive Green B Acra Conc.	542.75
Brown R Pdr. Fine	747.38
Brown G Pdr. Fine	795.00
Dark Brown 3R Fine	685.00
Brown G Supra Disp.	449.90
Brown 2G Supra Disp.	554.00
Brown R Supra Disp.	422.95
Brown BR Powder	719.00
Dark Brown 3R Ptg. Paste	217.15
Dark Brown 3R Supra Disp.	414.55
Brown G Acra Conc.	733.95
Brown M. Powder Fine	768.80
Grey M. Supra Disp.	585.45
Blue BC Acra Conc. Pdr. Fine	762.70
Direct Black AC Supra Disp.	330.35
Direct Black AC Pdr. Fine	474.70
Direct Black CH Supra Disp.	393.20
Direct ACD Ptg. Paste	217.15

Delhi Market

DELHI: APRIL 13, (NNS) Caustic soda flake prices jumped up sharply by Rs. 50 per 50 kg on increased export and tight supply position. Mercury also went up by Rs. 150 per flask due to higher Bombay advices. Chatkolite lost Rs. 250 thanks to fresh supply from Bombay. Paraffin wax and citric acid decreased by Rs. 10/50.

Soda caustic flake prices jumped up by Rs. 50 at Rs. 520/525 per 50 kg to touch a high level on account of heavy export coupled with the increase in prices made by manufacturers on account of rise in rail freight and electricity charges. During the past one month the chemicals recorded a net rise of Rs. 100. It was reported that the production of chemicals in the South and Gujarat had declined on account of power break-down. Soda bicarb NAL and soda ash PNFC NAL Gujarat, Birla and Tata rose by Rs. 3/5 per bag on good demand and hike in prices by manufacturers.

After showing a rise of Rs. 5 at Rs. 80 per kg due to tight stock position and stockists manipulation, titanium dioxide anatase turned easy by Rs. 2 at Rs. 78 per kg thanks to fresh receipts of three truck loads. Despite the reaction the metal was higher by Rs. 3 over the previous weeks. Titanium dioxide RC 822 flared up from Rs. 82 to Rs. 83 per kg and touched a new high level on hopes that the manufacturer would enhance the prices of the metal. Stockists were eager buyers. Demand from paints and plastic industries was satisfactory.

Citric acid suffered a fall of Rs. 50 at Rs. 2,300/2,500 per 50 kg thanks to fresh arrivals from China and Bombay Dyeing goods. On the absence of fresh demand, tartaric acid remained subdued at Rs. 7,250. Paraffin wax was easy by Rs. 10 at Rs. 690 per 50 kg. Chatkolite lost Rs. 2.50 at Rs. 54.50 on account of fresh supply of 5 tonnes from China. Sufolite was quoted at Rs. 60 and Rangolite Germany at Rs. 69. Sodium hydrosulphite remained quiet in the absence of sufficient demand from gur makers.

Menthol moved in a narrow range during the major parts of the week with restricted turnover. Arrivals from Sambhalpur, Moradabad, Rampur, Amroha and Chandousi were negligible. Bold quality closed the week higher by Rs. 5 at Rs. 295. Flake was up by Rs. 3 at Rs. 248. Naphthalene ASBS rose by Rs. 35 at Rs. 250 per kg. Basic violet increased by Rs. 3/10 at Rs. 145/170. The market remained closed on Friday the 14th April, 1989 due to 'Ram Navmi'.

(DELHI MARKET RATES AS ON APRIL 13, 1989)

Ammonia Bicarb (Per 25 Kg.)	135.00
Mercury (Per flask)	12,400.00
Soda ash (Per bag)	335/350.00
Ammonium Chloride (50 Kg.)	110/180.00
Caustic soda flakes (50 Kg.)	520/525.00
Citric acid (Per 50 Kg.)	2,300/2,500.00
Stable Bleaching Powder Shriram (Per 25 Kg.)	100.00
Stable Bleaching Powder KCl (Per 25 Kg.)	95.00
Stable Bleaching Powder Maruti (Per 25 Kg.)	90.00
Stable Bleaching Powder Modi (Per 25 Kg.)	98.00
Sodium Bicarbonate (50 Kg.)	280/298.00
Sodium Hydrosulphite (Per Kg.)	35.50/40.00
Rangolite (Per Kg.)	54.50/69.00
Boric acid Technical (Per 50 Kg.)	1,175.00
Paraffin Wax (Per 50 Kg.)	690.00
Tartaric Acid (Per 50 Kg.)	7,250.00
Borax Granular (Per 50 Kg.)	670.00
Borax Crystal (Per 50 Kg.)	670.00
Sodium Nitrite (Per 50 Kg.)	660/750.00
Sodium Nitrate (Per 50 Kg.)	415.00
Camphor Thal (Per Kg.)	125
Camphor Powder (Per Kg.)	115
Menthol Bold (Per Kg.)	295
Menthol Medium (Per Kg.)	280
Menthol Flake (Per Kg.)	248
Glycerine (Per Kg.)	48/50
Sodium Silicate (Per quintal)	250/300
Hexamine (Per Kg.)	34
Acetic Acid Glacial (Per Kg.)	16
Copper Sulphate (Per quintal)	2,400/2,6
Formic Acid (Per Kg.)	25
Formaldehyde (Per Kg.)	8
Hydrogen Peroxide (Per Kg.)	28
Calcium Carbonate (Per Tonne)	2,500/4,0
Acid Slurry Soft (Per Kg.)	24
Acid Slurry Hard (Per Kg.)	32
Phosphoric Acid (Per 50 Kg.)	935
Potassium Nitrate (Per quintal)	900/1,200
Potassium Permanganate (Per 50 Kg.)	3,350
Sodium Bichromate (Per 50 Kg.)	1,600/1,625
Trisodium Phosphate (50 Kg.)	550
Titanium Dioxide Anatase (Per Kg.)	78
Titanium Dioxide RC-822 (Per Kg.)	83
Zinc Oxide (Per metric tonne)	40,000/45,000
Phenol Carbolic Acid (Per Kg.)	37
Carbon Tetrachloride (Per Kg.)	21
Chloroform (Per Kg.)	28
Sodium Sulphate (Per metric tonne)	3,200/3,500
Naphthalene Balls (Per 50 Kg.)	1,450

DYES & COLOURS	(Per K
Naphthol AS	162
Naphthol ASG	252
Naphthol ASBS	250
Naphthol ASTR	325
Naphthol ASOL	208
Naphthol ASBO	225

DIRECT DYES	(Per K
Black E. Conc.	110/160
Diazo Black B.T.	105/135
Green B	100/127
Blue 2-B	60/92
Sky Blue FB	213
Basic Auramine	55/110
Basic Rhodamine	250-400
Basic Methylene Blue	92/130
Basic Violet	145/170
Basic Malachite Green	150/165
Acid Orange	45/85

Madras Market

Activity in chemical market this week lack-lustre. Benzene prices came down on better availability. Titanium dioxide prices ruled high due to non-arrivals and reported strike at TTP, Trivandrum unit. There have been good arrivals of imported methylene chloride as a result of which the prices have dropped down marginally affecting sale of indigenous materials. Isopropyl alcohol was in great demand due to poor arrivals from the only indigenous manufacturer NOCIL as its production is being diverted for meeting the requirements of exporting units.

(MADRAS MARKET RATES AS ON APRIL 15, 1989)

Acetic Acid Glacial (per kg)	19.00
Aluminium Sulphate Iron free (per MT)	3,000.00
Ammonium Bicarbonate (per 25 kgs)	125.00
Ammonium Chloride (per MT)	3,000.00
Acid Slurry (per kg)	27.50
Barium Carbonate (per kg)	6.00
Barium Chloride (per kg)	5.50
Boric Acid Technical (per kg)	24.00
Bleaching Powder (per 50 kgs)	215.00
Borax (per 50 kgs)	650.00
Caustic Soda Flakes -- Mettur Chemicals (per MT)	9,300.00
Caustic Soda Flakes -- Andhra Sugars (per MT)	9,300.00
Calcium Chloride 70% Solid (per MT)	2,750.00
Calcium Chloride Anhydrous (per MT)	5,500.00
Calcium Carbonate (Activated) (per MT)	5,750.00
Calcium Carbonate (Precipitated) (per MT)	4,750.00
Citric Acid (per kg)	46.00
Copper Sulphate (per kg)	21.00
Cresylic Acid 98-99% (per kg)	107.00+ED
Pure Para Cresol 96% (per kg)	84.00+ED
Meta Para Cresol 42% (per kg)	46.00+ED
Formic Acid (per kg)	26.00
Formaldehyde (per kg)	8.00
Glue Flakes (per kg)	15.00
Glycerine (per kg)	45.00
Hydrosulphite of Soda (TCPL) (per kg)	37.00
Hydrosulphite of Soda (IDI) (per kg)	42.00
Hydrosulphite of Soda (BASF) (per kg)	42.00
Hexamine (per kg)	30.00
Hyflo Superceil (per kg)	23.00
Hydrogen Peroxide (per kg)	29.00
Litharge (per kg)	40.00
Lead Acetate (per kg)	42.00
Magnesium Carbonate (per kg)	18.00
Magnesium Chloride (per kg)	3.00
Maleic Anhydride (per kg)	48.00
Menthol Crystals (per kg)	340.00
Oxalic Acid (per kg)	24.00
Paraffin Wax (per kg)	15.00
Potassium Bichromate (per kg)	36.00
Phosphoric Acid (per kg)	20.00
Polyvinyl Alcohol powder (per kg)	140.00
Pentaerythritol (per kg)	52.00
Phthalic Anhydride (per kg)	40.00
Soda Ash (TAC) (per 75 kgs)	360.00
Soda Ash (TATA) (per 75 kgs)	360.00
Sodium Bicarbonate (TATA) (per 50 kgs)	360.00
Sodium Silicate (per MT)	5,000.00
Sodium Bichromate (per kg)	25.00
Sodium Nitrate (per kg)	8.00
Sodium Nitrite (per kg)	15.00
Sodium Sulphide Flakes (per kg)	13.00
Sodium Bisulphite (per kg)	4.00
Sodium Alginate (per kg)	140.00
Sodium Acetate (per kg)	7.00
Sodium Sulphate (Anhydrous) (per kg)	3.00
Titanium Dioxide (Anatase) (per kg)	68.00
Titanium Dioxide (Rutile) (per kg)	93.00
Trisodium Phosphate (per kg)	7.00
Urea (Technical) (per kg)	3.00
Zinc Oxide (per kg)	36.00
Zinc Chloride Powder (per kg)	13.00
Zinc Sulphate (per kg)	5.70

SOLVENTS

Acetone -- HOCL (per kg)	18.75
Butanol (per kg)	35.00
Butyl Acetate (per kg)	42.00
Benzene (per lit)	13.00
Cellosolve (per kg)	52.00
Carbon Tetra Chloride (per kg)	18.50
Chloroform (per kg)	26.00
Diacetone Alcohol (per kg)	29.00
Diethylene Glycol (per kg)	45.00
Dichloroethane (per kg)	17.00
Di-octyl Phthalate (per kg)	48.00
Di-N-butyl Phthalate (per kg)	48.00
Ethyl Acetate (per kg)	24.00
Isopropyl Alcohol (per kg)	29.00
Methanol (per kg)	11.00
Methylene Chloride (per kg)	25.00
Methyl Ethyl Ketone (per kg)	46.00
Methyl Isobutyl Ketone (per kg)	38.50
Phenol (per kg)	35.00
Sorbitol (per kg)	15.00
Triethanolamine (per kg)	60.00
Trichloroethylene (per kg)	24.00
1-1-1 Trichloroethane (per kg)	28.00
Turpentine (per lit)	17.00
Toluene (per lit)	18.00
Xylene (per lit)	18.00

International Bulk Chemical Prices

Spot prices are as on March 21, 1989

Naphtha prices moved up to $175-177/ton. Ethylene prices remained static at $875-900 with no spot material available. Lack of sustained demand brought down propylene prices to $618-635/ton. Butadiene prices firmed slightly but remained in the range of $260-280/ton f.o.b. Benzene slipped to $445-450 with a marginal fall on the higher end of the range. Toluene remained stable. Paraxylene and orthoxylene prices tumbled following high inventories and lack of demand. Xylenes reflected the bearish feeling in aromatics with solvent grade down to $460-465/ton and virgin down to $465-470/ton. Methanol went down slightly despite tightening supplies due to maintenance turnarounds.

Product	European Spot price range $/ton	US price range $/ton
Ethylene	875- 900 (cif)	738- 749
Propylene (100% basis)	618- 635 (cif)	440- 505
Butadiene	260- 280 (fob)	396- 418 (spot)
Benzene	445- 450 (fob)	450- 453 (spot)
Toluene	350- 355 (fob)	349- 355 (spot)
Xylenes (virgin)	465- 470 (fob)	448- 471 (spot)
(solvent)	460- 465 (fob)	n.a.
Styrene	1080-1090 (T2) (fob)	991-1013 (spot)
	980- 990 (T1) (cif)	
Paraxylene	770- 780 (fob)	n.a.
Orthoxylene	475- 480 (fob)	n.a.
Ammonia	168- 170 (c&f)	142- 150 (fob)
Methanol	166- 170 (T2) (fob)	163- 166 (fob)
	151- 154 (T1) (cif)	
Naphtha	175- 177 (cif)	n.a.

Shipping News*

VESSELS DUE IN BOMBAY FOR EXPORT LOADING

Due Date (1)	Steamer's Name & Flag (2)	Agents (3)	Will load for (4)	Approx. sailing dt. (5)
21/4	Uni Pioneer (Voy-005)	Greenways	New York; Newark; Baltimore; Charleston; New Orleans; Houston; Boston; Providence (Ri); Philadelphia; Norfolk; Savannah; Jacksonville; Wilmington; Miami; Montreal; Toronto; Bermuda; Los Angeles; Longbeach; Sanfrancisco; Oakland; San Diego; Stockton; Richmond; Almeida; Redwood City; Sacramentos; Seattle; Portland; Vancouver (B.C.); Tacoma; Longview; Chicago; Dallas; Various inland destinations and Caribbean Ports & S. American Ports. (Carting at G/H Cotton Depot).	28/4
22/4	Ocean Strength (Voy-12 A/B)	O.S.A.	New York; Baltimore; Philadelphia; Houston; Boston; Chicago; Dallas. Atlanta; Savannah; Norfolk; Charleston; Los Angeles; Sanfrancisco; Oakland; Seattle; Vancouver; Toronto; Montreal; Portland; Tacoma & S. American & W. Indies Ports. (Carting M-178/180, Cotton Depot).	27/4
23/4	Seacrest Pioneer (Voy-010)	Seaspeed	New York; Baltimore; Norfolk; Savannah; Charleston; Houston. & S. American Ports. (Carting at Hay Bunder No. 3).	28/4
27/4	Robert E. Lee (Am)	Samarth	Philadelphia; Baltimore; Norfolk; New Orleans; Houston; Savannah. New York. (Carting at P/Q-PD).	28/4
25/4	Supanya (Voy-24)	Samrat/	Longbeach; Oakland; Seattle; Los Angeles; Sanfrancisco; Philadelphia; Savannah; Charleston; Baltimore; Norfolk; New York; Boston; St. John; Vancouver; Montreal; Toronto; New Orleans; Houston. (Carting at M.B.).	30/4
		U.L.A.	Los Angeles; Sanfrancisco; Oakland; Seattle; Vancouver; Charleston; Houston; Norfolk; Baltimore; New York; Halifax; Montreal; Toronto; S. American & West Indies Ports. (Carting at M-171/173 C.D.)	

These dates of departure/arival are tentative. On account of the strike at all ports it is likely that there may be delays.

(1)	(2)	(3)	(4)	(5)
		E.S.P.L./	Longbeach; Charleston; New York; St. John; Norfolk; Oakland; Vancouver (B.C.); Seattle; Montreal; Baltimore; Boston; Chicago; Dallas; Houston; Longview; Los Angeles; New Orleans; Philadelphia; Portland; San Diego; Mexico City; Sanfrancisco; Siouxfall; Sacramento; Stockton; Halifax; Toronto; Savannah; Tacoma; Miami and all other destinations; also Caribbean Ports. (Carting at M.B.)	
		Trident/	South America; Caribbean & Central American Ports. (Carting 7-W/H-PD).	
		Arebee	S. American Ports. (Carting at M-Jetha Cotton Depot).	
21/4	Uni Pioneer (V-005)	Greenways	Hamburg; Felixstowe; Rotterdam; Antwerp; Le Havre; Leghorn; Genoa; Marseilles (Fos); Valencia; Barcelona; Limassol; Las Palmas; Casablanca; Istanbul. (Carting at G/H Cotton Depot).	28/4
23/4	Seacrest Pioneer (Ger) (V-010)	Merzario/	Jeddah; Hodeidah; P. Sudan; Ravenna; Ancona; Piraeus; Venice; Trieste. (Carting at M.O.D. No. 2).	28/4
		Seaspeed/	Tilbury; London; Felixstowe; Manchester; Liverpool; Avonmouth; Le Havre; Rotterdam; Hamburg; Antwerp; Bremerhaven and Scandinavian Ports. (Carting at Hay Bunder No. 5).	
		L. Triest	Jeddah; Trieste; Venice; Ravenna; Rijeka; Naples. (Ctg. M-171/173 CD).	
25/4	Supanya	E.S.P.L.	Le Havre; Rotterdam; Felixstowe; South Hampton; Hamburg;	30/4
27/4	Robert E Lee	Samarth	Assab. (Carting at P/Q-PD)	28/4
21/4	Uni Pioneer (V-005) (Pan)	Greenways	Singapore; Penang; Port Kelang; Bangkok; Djakarta; Surabaya; Manila; Cebu; Kaohsiung; Keelung; Osaka; Yokohama; Kobe; Shimizu; Moji; Nagoya; Pusan; Hongkong. (Carting at G/H Cotton Depot)	28/4
21/4	M. Olminskiy	Transocean	Main Japan Ports.	30/4
22/4	Ocean Strength (Voy-12A/B)	O.S.A./ Tata Tea	P. Kelang; Singapore; Kaohsiung; Hongkong; Bangkok; Kobe; Yokohama; Nagoya; Moji; Osaka; Busan; Tokyo; Simizu; Keelung; Tsingtao; Quindao; Xiangang; Shanghai. (Carting at M-178/180 C.D. for O.S.A.). (Carting at Timber Pond No. 4, for Tata Tea).	27/4
		M.S.P.L.	Singapore; Bangkok; P. Kelang; Penang; Jakarta; Manila; Hongkong; Keelung; Kaohsiung. (Carting at Hay Bunder No. 4).	
23/4	S/o. Nagaland	S.C.I.	Main Japan Ports.	30/4
25/4	Supanya (V-24)	Samrat/	Singapore; Penang; Jakarta; Surabaya; Belawan; P. Kelang; Bangkok; Manila; Hongkong; Kaohsiung; Keelung; Taichung; Busan; Yokohama; Nagoya; Kobe; Osaka; Tokyo. (Carting Mallett Bunder).	30/4
		Trident/	Busan; Hongkong; Keelung; Kobe; Nagoya; Yokohama; Penang; P. Kelang; Bangkok; Kaohsiung; Singapore. (Carting at 7-W/H-PD).	
		U.L.A./	Singapore; Penang; P. Kelang; Keelung; Kaohsiung; Bangkok; Busan; Chinese Ports. (Carting at M-171/173 Cotton Depot).	
		E.S.P.L./	Dalian; Quindao; Tianjin (Xiangang): Nawtong; Shanghai; Ningbo; Xiamen; Fuzhou; Guangzhou; Whampoa; Vietnam. (Carting at M.B.).	
		Transworld/	P. Kelang; Penang; Keelung; Kaohsiung; Busan; Bangkok; Kobe; Yokohama; Nagoya; Tokyo; Shimizu. (Carting M-178/180 C.D.).	
		Kanika	Penang; Jakarta; Surabaya; Belawan; P. Kelang; Bangkok; Manila; Hongkong; Kaohsiung; Keelung; Taichung; Busan. (Carting T.B. 3).	
7/4	Robert E. Lee	Samarth	Singapore. (Carting at P/Q-PD)	28/4
2/4	Ocean Strength	O.S.A.	Sydney; Melbourne; Adelaide; Brisbane; Fremantle; Auckland; Wellington; Lyttelton; P. Chalmers. (Carting M-178/180 C.D.).	27/4
5/4	Supanya	Samrat/	Brisbane; Sydney; Melbourne; Adelaide; Fremantle; Burnie. (Carting at Mallet Bunder).	30/4
		Trident/	Brisbane; Sydney; Melbourne; Adelaide; Fremantle; Burnie; Auckland; Wellington; Lyttelton. (Carting at 7-W/H-PD).	
		Arebee/	Sydney; Melbourne; Adelaide; Brisbane. (Carting at M-Jetha C.D.)	
		Transworld/	Sydney; Melbourne; Adelaide; Fremantle; Burnie; Brisbane. (Carting at M-178/180 Cotton Depot).	
		Kanika	Brisbane; Sydney; Melbourne; New Castle; Adelaide; Fremantle; Auckland; Wellington; Lyttleton. (Carting at Timber Bond No. 3).	
5/4	Seacrest Pioneer (Voy-010)	Merzario/	Dubai; Sharjah; Abu Dhabi; Muscat; Doha; Dammam; Kuwait; Bahrain; (Carting at M.O.D. No. 2 for Merzario).	28/4
		L. Triest/	Dubai; Dammam; Riyadh; Muscat; Abu Dhabi; Doha; Kuwait; Bahrain. (Carting at M-171/173 Cotton Depot for L. Triest)	
		Seaspeed/	Dubai; Dammam; Bahrain; Kuwait; Doha. (Carting at H.B. No. 5).	
		Parekh	Muscat; Dubai; Sharjah; Abu Dhabi. (Carting at Hay Bunder No. 4).	
/4	Seacrest Pioneer	Seaspeed	West African Ports. (Carting at Hay Bunder No. 5).	28/4
/4	Supanya	U.L.A./ Trident	Lagos; Apapa; Abidjan; Lome; Matadi. (Carting at M-171/173 C.D.) Tema/Lome; Lagos; Matadi; Lobito; Luanda; Freetown; Cotonou; Douala; P. Harcourt; Abidjan; Monrovia; Dakar. (Carting 7-W/H-PD).	30/4

VESSELS DUE IN BOMBAY FOR IMPORT DISCHARGE

ue Date	Steamer's Name	Agents	From
/4	Nedlloyd Everest	Patvolk/S.W.& Co./Tata Tea/Trident	U.K. Cont. & U.S.A.
/4	Robert E Lee	Samarth	U.S.A.
/4	S/o. Haryana	S.C.I.	U.K. Cont.

MATERIALS IMPORTED

BOMBAY

(From 2-2-89 to 8-2-89)

(Contd from the Previous Issue)

FORMIC ACID 85% : From FRG: Mohammed Hanif & Sons, 37.380 kgs., Rs. 3,48,474; Tata Exports Ltd., 25.200 kgs., Rs. 2,18,915.

FURFURYLAMINE: From France: Hoechst India Ltd., 3,080 kgs., Rs. 2,88,715.

GLYCERINE CRUDE: From Indonesia: The Godrej Soap Pvt. Ltd., 34 MTs., Rs. 3,60,244.

GLYCERYL TRINITRATE 10% LACTOSE 90% : From Italy : Cadila Chemicals Pvt. Ltd., 150 kgs., Rs. 32,008.

GUM ROSIN : From China: Allanasons Pvt. Ltd., 1,05.300 kgs., Rs. 8,42,616; From Indonesia: Asian Paints India Ltd., 1,-08,000 kgs., Rs. 8,47,764.

GUM ROSIN WW GRADE : From Indonesia: Resins and Plastics Ltd., 50,880 kgs., Rs. 3,99,-391.

GUM ROSIN : From Vietnam: Indian Chemicals and Allied Products, 2.239 MTs., Rs. 13,989.

HEPTACHLOR TECH : From USA: Pesticides India, 14,800 Lbs., Rs. 6,65,468; Tarapur Chemicals & Pesticides, 1995.83 kgs., Rs. 1,46,403.

HEXACHLOROCYCLOPENTADIENE: From USA: Bharat Pulverising Mills Ltd., 49,850 kgs., Rs. 13,75,268.

HEXANE DIOL : From FRG: Grauer & Weil (I) Ltd., 550 kgs., Rs. 57,529; Grauer & Weil (I) Ltd., 550 kgs., Rs. 57,529.

HYDRATED SILICA : From USA: Procter & Gamble India Ltd., 1,08,864 kgs., Rs. 25,51,-010.

HYDROBROMIC ACID : From Japan: Reliance Industries Ltd., 33 MTs., Rs. 4,02,390.

HYDROQUINONE : From Japan: Asia Trade Enterprises, 2,-000 kgs., Rs. 1,01,484; JRC Industries, 2000 kgs., Rs. 1,01,-483; From Japan: Raj Prakash Chemicals Ltd., 4 MTs., Rs. 2,-02,967.

HYDROSULPHITE CONC : From FRG: Anil Enterprises, 4,-800 kgs., Rs. 91,453.

HYDROXYLAMINE HYDROCHLORIDE: From FRG: Kantilal Manilal & Co., 500 kgs., Rs. 44,085.

HYDROXYLAMINE SULPHATE: From FRG: Apte Amalgamations Ltd., 54,000 kgs., Rs. 15,18,-000 ; From Netherlands : Apte Amalgamations Ltd., 40,000 kgs., Rs. 11,27,912; From USA: Roche Products Ltd., 16,000 kgs., Rs. 4,35,313.

HYDROXYQUINOLINE : From France : G. Amphray Laboratories, 3,000 kgs., Rs. 5,48,-714.

IODINE CRUDE : From Japan: Kirti Chemicals, 1000 kgs., Rs. 2,98,439; Lub Cut Incorporation, 2000 kgs., Rs. 5,78,659.

IODINE CRUDE 99.5% MIN : From Japan: Calibre Chemicals Pvt. Ltd., 3,000 kgs., Rs. 8,95,-219.

ISOBORNYL ACETATE: From FRG: Dujodwala Industries, 125 MTs., Rs. 19,39,440.

ISOBUTYL BENZENE : From USA: The Boots Co. India Ltd., 30,108 Lbs., Rs. 6,80,686.

ISOBUTYL BENZENE PURE: From USA: Suneeta Laboratories Ltd., 13.657 MTs., Rs. 6,80,-686.

ISOBUTYRIC ACID : From FRG: Hindustan Lever Ltd., 3,000 kgs., Rs. 65,289.

ISOPHORONE : From Japan : Goodlass Nerolac Paints Ltd., 3,-040 kgs., Rs. 60,236; Southern Sea Foods Pvt. Ltd., 5,130 kgs., Rs. 1,01,649.

ISOPHORONE DIISOCYANATE: From FRG: Engineered Polymers (I) Pvt. Ltd., 60 kgs., Rs. 9,-568.

ISOPROPANOL : From USA : Gujarat Narmada Valley Fertilizer, 40 kgs., Rs. 17,162.

ISOPHYTOL: From FRG: E. Merck (I) Ltd., 5,100 kgs., Rs. 10,44,101.

ITACONIC ACID: From USA: Asian Paints India Ltd., 3,275 kgs., Rs. 1,77,208.

L-LYSINE HCL: From Japan: R.K. Chemical, 2,500 kgs., Rs. 1,63,852.

L-LYSINE MONO HCL USP: From Korea: K. Sevantilal & Co., 1,000 kgs., Rs. 89,166.

LAURYL DIMETHYLAMINE OXIDE: From UK: Pacific Export, 1,000 kgs., Rs. 43,565.

LITHIUM HYDROXIDE MONOHYDRATE: From USA: Yale International (Impex) Ltd., 1,361 kgs., Rs. 88,480.

LITHIUM METAL : From FRG: Roche Products Ltd., 500 kgs., Rs. 4,22,354.

LYSINE HYDROCHLORIDE : From Japan: Biological E. Limited, 3,000 kgs., Rs. 2,16,742.

MANCOZEB TECH : From France: Indofil Chemical Co., 98,-000 kgs., Rs. 31,36,815; From Italy: Crop Health Products Pvt. Ltd., 42,000 kgs., Rs. 13,44,-348.

MELAMINE PURE: From USA: Caprihans India Ltd., 34,246 MTs., Rs. 7,80,360.

MERCAPTO BENZOIC ACID : From UK: Canning Mitra Phoenix Ltd., 25 kgs., Rs. 40,286.

METHYL IONONE GAMMA : From Japan: Allied Chemicals (I) 150 kgs., Rs. 57,158.

3-METHYL THIOPHENE : From UK : Kantilal Manilal & Co., 1,200 kgs., Rs. 5,30,018.

METHYLENE BROMIDE : From USA: Pesticides India, 37,800 Lbs., Rs. 7,08,664.

METHYLENE CHLORIDE: From France: Gujarat Lyka Org. Ltd., 19,760 kgs., Rs. 1,86,733; From Netherlands: Apte Amalgamations Ltd., 18,615 kgs., Rs. 1,77,332.

METHYLENE DIANILINE MIXTURE: From USA: Intec Polymers Pvt. Ltd., 1,996 kgs., Rs. 2,28,173.

METHYLENE MALONIC ACID ESTER: From FRG: Skom Chemicals, 400 kgs., Rs. 79,259.

META TOLUENE DIAMINE CRUDE: From Japan: Furia Chemicals, 1000 kgs., Rs. 93,739; Satya Aromatic Industries, 2000 kgs., Rs. 85,589.

MOLYBDENUM DISULPHIDE: From UK: Indian Oil Corporation Ltd., 5,000 kgs., Rs. 6,96,669.

MONOCHLORO PENTAFLUOROETHANE: From UK : Navin Fluorine Industries, 3,000 kgs., Rs. 2,33,204.

MONOCROTOPHOS TECH. 74% MIN: From Switzerland: Pesticides India, 12,320 kgs., Rs. 9,10,744.

MONOCROTOPHOS TECH : From Taiwan: Gujarat Agro Industries Corpn., 15,000 kgs., Rs. 13,46,636.

MONOCROTOPHOS TECH 70%: From Taiwan; Gujarat Agro Inds. Corpn. Ltd., 32,000 kgs., Rs. 25,36,278.

MONOETHYL ANILINE N ETHYL ANILINE: From FRG: Atul Products Ltd., 28,800 kgs., Rs. 13,74,931.

MONOETHYLENE GLYCOL : From Singapore: Dr. Beck & Co. (I) Ltd., 95,175 kgs., Rs. 26,83,726; Noble Explochem Ltd., 18,300 kgs., Rs. 5,16,866.

N-BUTANOL : From Netherlands: Dr. Beck & Co (I) Ltd., 15,600 kgs., Rs. 2,27,452.

N-ETHYLANILINE: From USA: Navin Chemical Enterprises, 14,652.8 kgs., Rs. 6,79,399.

N-PROPYL BROMIDE: From Netherlands : Suneeta Laboratories Ltd., 4,200 kgs., Rs. 2,14,455.

NN-DIETHYL ANILINE : From FRG: Sudarshan Chemical Inds., 3,040 kgs., Rs. 1,85,664; From China: Priya Chemicals, 24,000 kgs., Rs. 8,96,232; From Korea: Ravichem Dye 16,000 kgs., Rs. 5,85,295; From Spain : Ravi Chem Dye, 15,600 kgs., Rs. 4,39,886.

NN DI SEC. BUTYL 1,4 BENZENE DIAMINE: From UK : Kubo Combustion Efficiency Chemical, 950 kgs., Rs. 29,107.

NAPHTHALENE CRUDE: From Brazil: Dintex Dyechem Pvt. Ltd., 20,274 kgs., Rs. 1,96,226; From Canada: Beta Naphthol Pvt. Ltd., 30,000 kgs., Rs. 2,78,929.

OCTAMETHYL CYCLO TETRA SILOXANE: From FRG: Hico Products Ltd., 14,400 kgs., Rs. 6,27,534.

OCTOIC ACID : From FRG : Narchem Industries, 14,430 kgs., Rs. 2,37,080.

OCTOIC ACID 2 ETHYLENE HEXANOIC ACID : From FRG: Modern Chemical & Plastics, 14,430 kgs., Rs. 2,38,321.

ORTHO TOLUIDINE LIQUID: From FRG: Kabbur Industries Pvt. Ltd., 10,340 kgs., Rs. 2,53,619.

PARACHLORO TOLUENE : From FRG: The National Small Inds. Corpn. Ltd., 14,400 kgs., Rs. 4,27,343; From Japan: Arlabs Ltd., 15,000 kgs., Rs. 4,03,489.

PARA CRESIDINE: From Japan: Jansons Interaticnal, 1,044 kgs., Rs. 1,75,040

PARA CUMIDINE: From Japan: Montari Industries Ltd., 45,600 kgs., Rs. 33,73,167.

PARA HYDROXY PHENYL ACETAMIDE: From Japan: Win Laboratories Pvt. Ltd., 1,200 kgs., Rs. 7,43,206.

PARA OCTYL PHENOL: From Japan: Indian Plastics Ltd., 5,000 kgs., Rs. 1,21,937; From FRG: SM Dyechem Limited, 1,000 kgs., Rs. 28,094.

PARA TERTIARY BUTYL PHENOL : From Japan: Indian Plastics Ltd., 4 MTs., Rs. 91,453.

PHENYL PROPYL ALCOHOL : From FRG: Oriental Aromatics, 100 kgs., Rs. 13,290.

PHENYLENE DIAMINE: From FRG: Espee Chemicals, 4,987 kgs., Rs. 3,80,060.

PHOSPHORIC ACID : From USA: Indian Rare Earths Ltd., 4,989 kgs., Rs. 3,82,905.

PHOSPHOROUS PENTASULPHIDE: From France: Ficom Organics Ltd., 25.800 MTs., Rs. 4,71,894; Khatau Junker Ltd., 14,400 kgs., Rs. 2,63,382; From Italy: Hindustan Insecticides Ltd., 100 MTs., Rs. 19,05,257.

PHTHALIC ANHYDRIDE: From Finland: Colour Chem Ltd., 50,000 kgs., Rs. 5,60,146; From FRG: Sahyadri Dyestuffs & Chemicals, 1000 kgs., Rs. 2,32,052.

PIPERAZINE ANHYDROUS USP XXI PURE 99%: From Netherlands: Ranbaxy Labs Ltd., 6,240 kgs., Rs. 3,56,664.

PIVALOYL CHLORIDE: From France: Cepham Labs Ltd., 3,620 kgs., Rs. 2,28,118; Kopran Chemical Co. Ltd., 3,060 kgs., Rs. 1,96,685.

POLYVINYL ALCOHOL: From Japan: Shiv Sizers and Twisters, 2 MTs., Rs. 91,453; Shriram Vinyl & Chemicals, 4 MTs., Rs. 2,15,702; Yogiware Fabrics Pvt. Ltd., 1 MT., Rs. 45,727.

POLYVINYL CHLORIDE : From Saudi Arabia: Kamal Traders, 49.500 MTs., Rs. 7,62,027.

POTASSIUM CARBONATE : From France: Banaras Bead Mfg. Co., 234.90 kgs., Rs. 1,28,156.

POTASSIUM CHLORIDE: From Canada: Atul Products Ltd., 300 MTs., Rs. 8,44,479.

POTASSIUM CYANIDE: From Japan: BSM Chemicals, 16,000 kgs., Rs. 7,43,812.

POTASSIUM FERROCYANIDE: From FRG: Belami Fine Chemicals Pvt. Ltd., 5,000 kgs., Rs. 96,720.

POTASSIUM PERSULPHATE: From FRG: Kalva Chemicals Pvt. Ltd., 200 kgs., Rs. 4,420; PDI Chemicals Pvt. Ltd., 500 kgs., Rs. 11,050.

POTASSIUM SORBATE: From FRG: E. Merck (I) Ltd., 300 kgs., Rs. 34,785.

POTASSIUM SILICATE : From France : Samtel (I) Ltd., 108 MTs., Rs. 8,59,537.

PROPIONIC ACID : From FRG Hico Products Ltd., 16,380 kgs., Rs. 2,04,304.

PROPYLENE GLYCOL INDUSTRIAL: From USA: Unibond Industries, 4,300 kgs., Rs. 75,372; Unique Resins Industries, 6,450 kgs., Rs. 1,13,058.

PSEUDOIONONE 90%: From FRG: Seva Enterprises, 26,520 kgs., Rs. 27,87,845.

ROCK PHOSPHATE: From Jordan: The Dharamsi Morarji Chemical 1,200 MTs., Rs. 12,70,557.

SILICA CRYSTALLINE : From Japan: Milan Rubber Products, 100 kgs., Rs. 1,509.

SILICON DIOXIDE: From USA: Teletube Electronics Ltd., 300 Lbs., Rs. 15,019.

SODIUM CHLORITE 80%: From Spain: SK International, 4,-865 kgs., Rs. 1,55,715.

SODIUM CYANIDE POWDER: From FRG: Cheminor Drugs Pvt. Ltd., 30,600 kgs., Rs. 9,44,195.

SODIUM D PANTOTHENATE : From Japan: Parke Davis (I) Ltd., 250 Gms., Rs. 1,16,156.

SODIUM DI CHROMATE : From Italy: Raveshie Chemicals, 45,975 kgs., Rs. 9,32,002.

SODIUM FORMALDEHYDE SULPHOXYLATE: From China : Janki Prasad & Sons., Rs. 12 MTs., Rs. 1,83,819.

SODIUM FORMALDEHYDE SULPHOXYLATE 98% MIN : From China: Anand International 8 MTs., Rs. 1,22,546.

SODIUM HYDROSULPHITE CONC. : From FRG: Reliance Industries Ltd., 20,000 kgs., Rs. 2,47,328.

SODIUM LAURYL SULPHATE: From FRG: Climax International Corpn., 11,000 kgs., Rs. 3,40,-636.

SODIUM SACCHARIN: From USA: Procter & Gamble India Ltd., 4704 Lbs., Rs. 2,63,792.

SODIUM SULPHIDE: From China: Kalyani Steels Ltd., 40,-000 kgs., Rs. 1,68,730.

SORBIC ACID: From Japan: Himatlal H. Joshi, 500 kgs., Rs. 49,537; Unochem Industries, 1000 kgs., Rs. 96,025.

STEARIC ACID: From Singapore: Nirlon Syn. Fibres & Chem Ltd., 5,000 kgs., Rs. 59,444.

STEARYL ALCOHOL : From Spain: S.K. International 1,500 kgs., Rs. 46,450.

STRONTIUM CARBONATE : From Netherlands: Peico Electronics & Electricals 100 kgs., Rs. 2228.

SUCCINIC ACID: From Austria: Sandoz (I) Ltd., 2,000 kgs., Rs. 1,18,707.

SULPHUR INSOLUBLE: From FRG: J.K. Industries Ltd., 13.5 MTs., Rs. 4,12,247.

SULPHURIC ACID: From USA: Semi Conductor Complex Ltd., 19,739 Lts., Rs. 6,27,030.

SYNTHETIC IRON OXIDE : From FRG : Hindustan Metal Inds., 9,000 kgs., Rs. 1,27,429; Selective Minchem and Colour, 15,500 kgs., Rs. 2,19,462.

TERPINE HYDRATE B P.C : From Spain: The Boots Co. India Ltd., 1,500 kgs., Rs. 74,198.

TERTIARY DODECYL MERCAPTAN: From USA: Synthetics & Chemicals Ltd., 27.88 MTs., Rs. 5,33,364.

TERTIARY TRIOPYRYLAMINE (TRIOCTYL AMINE): From USA: Ballarpur Industries Ltd., 1,440 Lbs., Rs. 57,043.

THIOGLYCOLLIC ACID 80%: From FRG: Geoffrey Manners & Co. Ltd., 2,000 kgs., Rs. 1,11,-825.

THIONYL CHLORIDE: From FRG: Excel Ind. Ltd., 16,500 kgs., Rs. 1,80,252.

THIOUREA: From FRG: Dipak Laboratories, Pvt. Lt., 3,275 kgs., Rs. 1,07,323., Dye Intermediates Pvt. Ltd., 50,000 kgs., Rs. 14,47,-996 Shrenik Pharma Pvt. Ltd., 5,000 kgs., Rs. 1,56,231.

TITANIUM DIOXDE: From Austria: U.K. Paint Industries, 20 MTS., Rs. 7,01,134., From FRG : Century Enka Ltd., 17,500 kgs., Rs. 6,96,714 Inarco Limited, 10,-000 kgs., Rs. 4,22,205., J.K. Synthetics Ltd., 10 MTS., Rs. 4,10,933., From UK: Asian Paints India Ltd., 20,000 kgs., Rs. 7,63,-627 From USA: Asian Paints India Ltd., 15,000 kgs., Rs. 5,14,-410., From USA: Procter & Gamble India Ltd., 5,186 kgs., Rs. 2,39,648.

TOBIAS ACID: From China : Ajay Chem Industries, 5000 kgs., Rs. 2,66,736., From Thailand : Espee Chemicals, 7,632 kgs., Rs. 4,20,774 From China: Vivid Exports, 5,000 kgs., Rs. 2,95,696.

TOLUENE DI ISOCYANATE: From FRG: Tirupati Foams Pvt. Ltd., 7000 kgs., Rs. 2,42,198 VCM Polyurethanes Pvt. Ltd., 1,250 kgs., Rs. 45,346.

4 TOLUIDINE 3 SULFONIC ACID: From Korea: Colour Chem Ltd., 5,000 kgs., Rs. 3,17,035.

TRICHLORO ACETOPHENONE TECH: From Belgium: FDC Ltd., 500 kgs., Rs. 1,41,872.

TRIDODECYL STEARATE : From USA: Atic Inds. Ltd., 1,950 lbs., Rs. 37,153.

TRIETHYLAMINE: From Belgium: Lyka Labs Ltd., 2,660 kgs., Rs. 72,075.

TRIETHYL PHOSPHATE: From FRG: Colour Chem Ltd., 5,060 kgs., Rs. 2,23,662; From USA : Indian Dyestuffs Inds. Ltd., 3,-552 kgs., Rs. 1,62,404.

TRIMELLITIC ANHYDRIDE : From USA: Intec Polymers Pvt. Ltd., 900 Lbs., Rs. 1,55,012.

3,4,5 TRIMETHOXY BENZALDEHYDE: From France: New Generic Drug House Ltd., 4,000 kgs., Rs. 14,02,270; From Netherlands: Pragati Pharmaceuticals Pvt. Ltd., 1,000 kgs., Rs. 3,65,-809.

TRIMETHOXY BENZOIC ACID: From Hungary: Burroughs Wellcome (I) Ltd., 7,500 kgs., Rs. 12,46,038.

TRIMETHYL PHOSPHITE : From US: NOCIL 46,539.144 kgs., Rs. 16,66,978.

2,2,4 TRIMETHYL QUINOLINE POLYMERISED: From Korea: Puneet Resin Pvt. Ltd., 5,000 kgs., Rs. 1,37,178.

TRIPHENYL TIN FLUORIDE : From Switzerland: Bombay Paints & Allied Product 280 kgs., Rs. 78,954.

VANILLIN: From France: Quest International India Ltd., 3,000 kgs., Rs. 6,53,884.

XYLENOL 50: From Italy: Dr. Beck & Co. (I) Ltd., 109.200 MTs., Rs. 19,14,098.

ZINC OXIDE: From Singapore: Nirlon Syn. Fibres & Chem Ltd., 4,500 kgs., Rs. 1,13,172.

PLASTIC MATERIALS IMPORTED BOMBAY

(From 2-2-89 to 8-2-89)

CAPROLACTUM : From Belgium: The Baroda Rayon Corpn. Ltd., 277.50 Rs. 79,94,078; J.K. Synthetics Ltd., 497 MTs., Rs. 1,-43,17,322; From Netherlands: Jagatjit Cotton Textile Mills Ltd., 2,55,000 kgs., Rs. 73,45,910; The National Rayon Corpn., 153 MTs., Rs. 44,07,546; Nirlon Synthetic Fibres & Chem Ltd., 306 MTs., Rs. 88,15,092; Shree Synthetics Ltd., 102 MTs., Rs. 29,38,364; From USA: Garware Nylons Ltd., 250 MTs., Rs. 70,-11,346.

HDPE: From Brazil: Gilt Pack Ltd., 100 MT., Rs. 18,50,250; National Exports, 50 MTs., Rs. 9,25,956; Neo Sack Ltd., 90 MTs., Rs. 17,54,757; Okay Industries, 15 MTs., Rs. 2,77,786; Polyset Products Pvt. Ltd., 65 MT., Rs. 12,03,741; RHK Duro Plast Containers Pvt. Ltd., 50,000 kgs., Rs. 9,25,955; Sachdeva Enterprises, 50 MTs., Rs. 9,33,575; Silver Plasto Chem Pvt. Ltd., 40 MTs., Rs. 7,46,860; Sumitra Plastics Ltd., 200 MTs., Rs. 39,-93,419; From Saudi Arabia: The Supreme Industries Ltd., 24.750 MTs., Rs. 4,71,551; From Brazil: M/s. Unilite Plastic Ind. Pvt. Ltd., 25 MTs., Rs. 4,66,788; U.P.I. Pvt. Ltd., 25 MTs., Rs. 4,-66,788; V. Plast 50 MT., Rs. 9,-25,954; Wimco Pen Company, 70 MTs., Rs. 13,03,966; From FRG: Polyolefins Ltd., 3.63 MT., Rs. 96,610; From Hungary: National Plastic Enterprises, 49.5 MTs., Rs. 9,50,647; From Saudi Arabia: Bright Brothers Ltd., 24.750 MTs., Rs. 4,22,510; Cello Plastic Inds. Works, 49.500 MTs., Rs. 8,41,247; HEB & LUGG Inds. Ltd., 100.95 MT., Rs. 17,19,554; Hindustan Vacuum Glass Ltd., 17.150 MTs., Rs. 2,95,384; Satyanarayan Plastic Inds., 49.500 MTs., Rs. 8,41,247; From USA: N.H.O.C. Pvt. Ltd., 13.250 MTs., 2,02,-814

LDPE: From Finland: Usha Beltro Ltd., 64, MTs., Rs. 15,57,-072; From Japan: The Supreme Inds. Ltd., 16 MTs., Rs. 3,04,-841.

LDPE : From Singapore: Ecoplast Pvt. Ltd., 16.500 MTs., Rs. 3,34,487.

LINEAR LOW DENSITY POLYETHYLENE: From Netherlands: Kailash Structurals Pvt. Ltd., 16 MTs., Rs. 3,43,861.

PVC RESIN: From Brazil: The Bhor Industries Ltd., 200 MTs., Rs. 40,39,146; Radiant Cables Pvt. Ltd., 50 MTs., Rs. 10,09,786; From Japan: Straw Products Ltd., 1 MTs., Rs. 64,014.

PVC RESIN: From Korea: N.I.L.C.M Co. Pvt. Ltd., 25 MTs., Rs. 5,12,446; Nocil, 450 MT., Rs. 68,85,045; Oswal Cable Products, 50 MTs., Rs. 10,11,120; Prakash Pipes and Ind. Ltd., 1,-975 MTs., Rs. 3,05,02,533; From Mexico: The Bhor Industries Ltd., 200 MTs., Rs. 39,92,-952; Star Oxides & Chem Ltd., 130 MTs., Rs. 22,71,096.

PTFE RESIN : From Netherlands: Mechanical Packaging Ind. Pvt. Ltd., 500 kgs., Rs. 76,210.

POLYBUTENE: From USA: Lubrizol India Ltd., 162 MTs., Rs. 45,95,954.

POLYETHYLENE: From Sweden: Usha Beltron Ltd., 32.5 MTS., Rs. 8,12,530 Vindhya Telelinks Ltd., 178.550 MTS., Rs. 44,00,633.

POLYPROPYLENE: From Australia: Garware Wall Ropes Ltd., 2,88,000 kgs., Rs. 46,09,198., From Belgium: Asha Handicrafts, 15,000 kgs., Rs. 3,34,944 Bhurji Supertek Inds. Pvt. Ltd., 15 MTS., Rs. 3,34,944; From Brazil: Kamath Packaging Pvt. Ltd., 200 MTS., 38,21,327.

POLYPROPYLENE RESIN: From Bulgaria: Kanpur Plastipack Ltd., 100 MTs., Rs. 16,84,074; Nelco Engg. Indl. Pvt. Ltd., 100 MT., Rs. 16,86,385.

POLYPROPYLENE: From Belgium: Suru Chemicals & Pharm Pvt. Ltd., 1,250 kgs., Rs. 27,-150; From Canada: Gujarat Propack Ltd., 210.375 MTs., Rs. 38,47,857; From Czechoslovakia: Associated Brothers 126 MTs., Rs. 16,28,073; D. Jamnadas & Co., 14 MTs., Rs. 1,80,897; Darshit Enterprises, 28 MTs., Rs. 3,61,794; Fibro Plast Corpn., 28 MTs., Rs. 3,61,794; Gujarat Plastics, 14 MTs., Rs. 1,80,897; Kalpesh Plastic Industries, 5 6 MTs., Rs. 7,23,588; From France: Paresh Plastics, 24.750 MTs., Rs. 4,61,655; The Supreme Industries Ltd., 24.750 MTs., Rs. 4,88,144; From FRG: Hindustan Vacuum Glass Ltd., 15,-950 MTs., Rs. 3,18,306; From FRG: Rishi Packers Ltd., 31.250 MTs., 5,33,472; Triveni Industries, 15 MTs., Rs. 4,12,892; From Italy: Avadh Polytubes Pvt. Ltd., 15 MTs., Rs. 3,49,805; From Portugal: Midland Gases Pvt. Ltd., 29 MTs., Rs. 4,65,-457; Mohan Overseas Pvt. Ltd., 43.500 MTs., Rs. 6,97,785; From UK: Jawahar Lalphool Chand, 16,000 kgs., Rs. 3,43,-861; From Yugoslavia: Harkab Holding Pvt. Ltd., 93 MT., Rs. 10,28,724; Patel Plastic Corpn., 31 MTs., Rs. 5,42,911.

CAXTON

- Mono-Ammonium Phosphate
- Di-Ammonium Phosphate
- Mono-Sodium Phosphate - Crystals
- Mono-Sodium Phosphate - Anhydrous
- Sodium Acid Pyro Phosphate
- Di-Sodium Phosphate - Crystals
- Di-Sodium Phosphate - Anhydrous
- Tetra Sodium Pyro Phosphate
- Tri Sodium Phosphate - Anhydrous
- Mono Calcium Phosphate
- Di-Calcium Phosphate - $2H_2O$/Anhydrous
- Tri-Calcium Phosphate
- Mono Potassium Phosphate
- Di-Potassium Phosphate
- Tetra Potassium Pyro - Phosphate
- Sodium Acetate - Crystals
- Sodium Acetate - Anhydrous
- Tri Magnesium Phosphate
- Zinc Phosphate
- Aluminium Phosphate

Available in All Grades

TECH - C.P. - Pharma grade - A.R./L.R.

Manufacturers

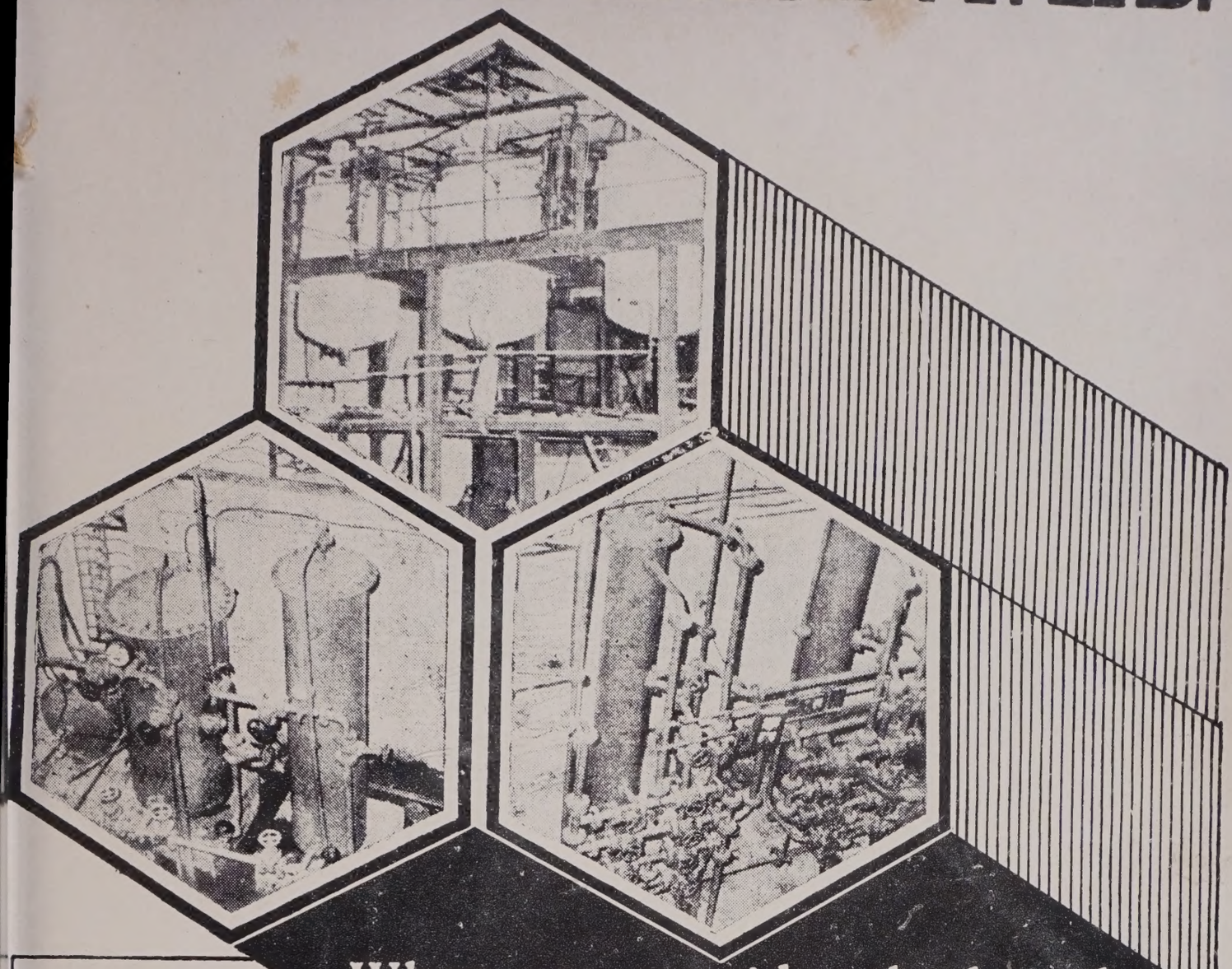
CAXTON CHEMICAL INDUSTRIES

Regd & Reply Office
CORNELIAN 104, AUGUST KRANTI MARG
5TH FLOOR, FLAT NO. 3, BOMBAY-400 036
PHONE: 38 05 43

Admn. Office
70, MASJID BUNDER ROAD, HANSRAJ KARAMSHI
BLDG, ROOM NO. 32, 3RD FLOOR, BOMBAY-400 003
PHONES: 855 05 25, 855 34 91, 855 26 72
GRAM: CAXCHEMIND, BOMBAY-400 036

FACTORY-
Village-Waliv VASAI (EAST)
Dist: Thane (MAHARASHTRA) Phone: 260

PLASTI PIGMENTS PVT. LTD.



When you consider the lengths PPPL goes to give service with good quality, everything it manufactures is surprisingly economical.

Manufacturers of :

Benzoyl Peroxide
Powder & Paste form.
Methyl Ethyl Ketone Peroxide.
Tertiary Butyl Hydro Peroxide.
Tertiary Butyl Per Benzoate.
Di-Tertiary Butyl Peroxide.
Cyclohexanone Peroxide.
M.I.B.K. Peroxide.
Synthetic Pearl Essence
various grades.

NO WONDER B.A.R.C., B.A.S.F. BAKELITE HYLAM LIMITED., ENTRUST THEIR ENTIRE REQUIREMENT OF PEROXIDE CATALYSTS TO PLASTI PIGMENTS

PLASTI PIGMENTS PVT. LTD.
401, SAI CHAMBERS,
365/367, NARSI NATHA STREET,
BOMBAY-400 009.
Tel : 337890-343688

WHERE SERVICE IS A WAY OF LIFE

REGD. NO. TN/MS (C) 395 ISSN 0045/6500 R. N. NO. 1972